DOCUMENT RESUME

ED 193 069 SE 032 975

AUTHOR	Peters, Linda, Ed.; And Others
TITLE	Course Goals in Biological and Physical Science, K-12.
INSTITUTION	Tri-County Goal Development Project, Portland, Oreg.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C.; Oregon State Board of Education, Salem.; Washington Office of the State Superintendent of Public Instruction, Olympia.
PUB DATE	73
NOTE	887p.; Not available in hard copy due to copyright restrictions.
AVAILABLE FROM	Commercial-Educational Distributing Services, P.O. Box 4791, Portland, OR 97208 ($33.00).
EDRS PRICE	MF06 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Biological Sciences; Career Education; *Classification; *Elementary Secondary Education; Objectives; *Outcomes of Education; Physical Sciences; School Districts; Science Education; *Science Programs; Values Education

ABSTRACT

Presented are course goals which make explicit statements of possible science learning outcomes in grades K-12. These were prepared cooperatively by three school districts within the state of Oregon. Accompanying this list of course goals is a taxonomy which provides four sets of indexes for retrieving course goals in these areas: science program goals, career education program goals, knowledge and process classifications, and science subject matter taxonomy. Goals are additionally coded as to grade level, predominant concept/value words and index words. (CS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED193069

OCT 1980
RECEIVED
ERIC/TM

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Bob Allenbrand

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

K-12

COURSE GOALS IN BIOLOGICAL AND PHYSICAL SCIENCE

A cooperative project of the Oregon school districts of Clackamas, Multnomah, and Washington Counties. Partially funded through grants from the Oregon Board of Education, the Office of the Superintendent of Public Instruction, State of Washington and the United States Office of Education, Department of Health, Education and Welfare.

SE 032 975

COURSE GOALS IN BIOLOGICAL AND PHYSICAL SCIENCE, K-12

Produced by the Tri-County Goal Development Project
Multnomah County Intermediate Education District
P. O. Box 16657, Portland, Oregon 97216

A cooperative project of the Oregon school districts of Clackamas, Multnomah, and Washington Counties. Partially funded by grants from the Oregon State Board of Education; the Office of the Superintendent of Public Instruction, State of Washington; and the United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the U. S. Office of Education; the Office of the Superintendent of Public Instruction, State of Washington; or the Oregon State Board of Education, and official endorsement should not be inferred.

Second Edition, Second Printing

© Copyright 1971, 1973, by the Oregon local and intermediate Education School Districts of Clackamas, Multnomah, and Washington Counties. All rights reserved. No part of this publication may be reproduced by any means, nor transmitted, nor translated into a machine language without permission of the Tri-County Goal Development Project.

COURSE GOALS
DEVELOPMENT

To inquire about the Project's theory or practice of Goal-Based Planning and Evaluation, contact:

Dr. Victor W. Doherty
or
Dr. Walter E. Hathaway
Portland Public Schools
631 N. E. Clackamas Street
Portland, Oregon 97208

To order, contact:

Commercial-Educational
Distributing Services
P. O. Box 8723
Portland, Oregon 97208

Disseminated by:

Northwest Regional
Educational Laboratory
710 S. W. Second Avenue
Portland, Oregon 97204

COURSE GOALS IN BIOLOGICAL AND PHYSICAL SCIENCE, K-12

TRI-COUNTY GOAL DEVELOPMENT PROJECT

Course Goal Developers for Original Critique Edition

Arthur Brachmann, Forest Grove
Charles Keith, Portland
Helen Koopman, Portland
Paula McCord, Milwaukie
Gene Meyer, Portland
Tom Miles, Portland
John Neeley, Portland
Natalie Oppenheim, Portland
Linda Stevenson, David Douglas
Karen Wedeking, Beaverton
Don Windsor, David Douglas
Fred Rugh, Salem

Major Contributors to Revised Edition

George Anasis, Portland
Arthur Brachmann, Forest Grove
Arleigh Dodson, Lewis & Clark
Harriet Eckman, Portland
Larry Gabel, Tigard
Richard McQueen, Multnomah IED
Donna Manning, Portland
Gene Meyer, Portland
Natalie Oppenheim, Portland
Phil Pennington, PSU
Linda Peters, Portland
Shirley Thielen, Portland
Robert Tinnin, PSU
Donald Tovey, Portland

Associate Editors

Donna Manning, Portland
Gene Meyer, Portland

Editor

Linda Peters, Portland

Media Resource

Harold Arendt, Portland
Alice Young, Lynch

Curriculum Resource

Raymond Thiess, Oregon State Board of Education
Richard McQueen, Multnomah County IED

Research, Supervision, and Training

Victor Doherty, Portland
Walter Hathaway, Portland

Project Coordinators

Robert Allenbrand, Multnomah IED
Walter Hathaway, Portland

Project Directors

Jack Allen, Multnomah IED
Peter Wolmut, Multnomah IED

Project Steering Committee

Jack Allen, Multnomah IED
George Anderson, Washington IED
Victor Doherty, Portland
Jim Gunderson, Multnomah IED
Ray Haag, Washington IED
Richard Harris, Clackamas IED
Richard Hermanson, Portland
Robert Rintoul, Clackamas IED
Edwin Schneider, Portland
Anna Thomas, Clackamas IED
Clifford Williams, Portland
Peter Wolmut, Multnomah IED
Robert Groeschell, State of Washington
Frank Mazzio, State of Oregon

TABLE OF CONTENTS

Page

Introduction i

Program Goals, Science (blue pages) xix

Program Goals, Career Education (green pages) xxiii

Knowledge and Process Classifications (yellow pages) xxvii

Science Taxonomy (pink pages) xxxi

Course Goals

1. Values and science 1

2. Processes and science 40

3. Biology 173

4. Chemistry 312

5. Physics 372

6. Earth and space sciences 588

7. Reading and science 758

8. Science and career education 773

Appendix I -- Value Issues and Science 803

Index 818

INTRODUCTION

You are an educator. You, better than anyone, know what you wish to teach. Often, however, you share ideas with your colleagues on important questions affecting your students and out of that sharing may come enriched learning.

For both personal and professional reasons, many educators are now asking themselves the question "What is to be learned?" This book is an effort by some of your fellow educators to share their thoughts on that question with you. They spent months writing and defining a set of goals which can be of service as you move toward your own response to the question "What is to be learned?"

The people who created this book view goals as a means of communicating about learning rather than as sources of confining, oversimplistic, and mechanistic control. Accordingly, the aim of this goal definition effort has been to provide a comprehensive and valid collection of nonprescriptive learning outcome statements purely as a resource for others interested in pursuing goal based learning and evaluation.

The next few pages will answer some of the questions you may have about the purpose, nature, and use of this collection. (For an in-depth discussion read the booklet "Introduction to Course Goals for Educational Planning and Evaluation.") We hope these suggestions will be helpful.

Why goals at all?

Education helps learners grow and change. Educators and learners must, therefore, decide and communicate to one another what changes are possible and desirable. Parents, school boards, and the community also have major roles to play in influencing educational growth and change. These responsibilities can best be carried out if those participating in decisions about education have alternatives stated in simple, clear, and explicit terms.

This collection contains a large number of concisely stated alternative learning outcomes of use to anyone involved in communicating about what might be learned. School systems can select and modify program goals. School staffs within a system can select and modify the more specific goals helpful in planning a course of instruction. Teachers can use selected as well as self-created goals to guide them as they devise experiences and testing methods.

What kind of goals are in this collection?

Levels. Figure 1 illustrates four possible levels of goals. Two of these levels of learning outcomes are included in this collection. Program goals describe general outcomes; course goals describe the specific outcomes relating to them. These goals differ in the type of planning for which they are suited. Program goals serve as guides to planning programs at district and subdistrict levels. Course goals serve as guides to planning courses in schools, departments, and classrooms.

At the system level the board of education is responsible for approving statements of purpose enunciating the district's philosophy of education. The district selection and adaptation of the program and course goals provided here will be guided by such statements of district goals.

Figure 1

PLANNING	System Goal:	The student knows and is able to apply basic scientific and technological processes.	
	Program Goal:	The student is able to use the conventional language, instruments, and operations of science.	To be found in the course goal collections.
	Course Goal:	The student is able to classify organisms according to their conventional taxonomic categories from observations, illustrations, or descriptions.	
	Instructional Goal:	The student is able to correctly classify as needleleaf cuttings of the following trees: hemlocks, pines, spruces, firs, larches, cypresses, redwoods, and cedars.	
MEASUREMENT	Behavioral Objective:	Given cuttings of ten trees, seven of which are needleleaf, the student is able to correctly identify which of the trees are needleleaves.	Not integral part of Tri-county Project System of Goal-Based Planning
	Performance Objective:	Given cuttings of ten trees, seven of which are needleleaf, the student is able to correctly identify at least six of the seven as belonging to the class of needleleaves.	

At the classroom teacher level the course goals must undergo a final translation into instructional goals and learning experiences. The Goal Development Project has chosen not to extend into this level of planning. The individual district and its teachers are best able to develop the resources and methods suitable for their students.

Types. The biological and physical science collection covers the "disciplines" of science and includes statements of what students can know and can do in the major content areas of Biological and Physical Science. In addition, there is a section on "2. Processes and science" in which goals have been written to aid the learning of both universal problem solving and inquiry processes and the conventional processes which run across all of science.

Values learning outcomes and issues in science are also described in an experimental section on "1. Values and science" and the appendix. The treatment of values concerns both helps for students to clarify their own value systems and statements of values they may wish to examine and ratify. This is the first effort of the Project to deal with the values dimension of science and, therefore, the goals, issues, and discussion are not meant to be comprehensive or final.

There are many reasons for this tentative attempt to deal seriously with the question of possible student outcomes in the area of values and attitudes, as well as the areas of knowledge and process. It is, for instance, becoming increasingly clear that exclusive concern for knowledge and process can not only be a very sterile approach to learning, but can also leave learners with seriously incomplete impressions, and perhaps worst of all, a negative attitude towards learning. Moreover, at this point in history, national events are revealing the serious implications of having knowledgeable and able individuals in sensitive and creative positions of public trust, if these individuals lack perspective, a sense of ethics, and personal integrity and responsibility. Also, in a practical sense, if the learning of science is to be effective, it must involve the student in highly personal, value laden interactions with that which is to be learned. We feel that the value clarification goals are unquestionably important and that the other value goals are acceptable within the frame of reference of science instruction, and would be assented to by practicing scientists as adding valid and needed perspective to the scientific enterprise.

A special problem has been encountered with an elementary science program now in wide use, the Elementary Science Study (ESS), and to a lesser extent with the Science Curriculum Improvement Study (SCIS). These programs are highly concerned with students' attitudes and perceptions in affective and value areas, and are only secondarily concerned with the subject matter of science, using science knowledge and processes as experiential bases for achieving more important though loosely stated (or often unstated) value goals. The values contributions of this collection should contribute to the use and defense of the use of these programs, and we have further endeavored to state knowledge (and/or process) goals for each ESS and SCIS unit, and surprised ourselves in finding knowledge goals that should satisfy all but the most liberated notions of ESS (and SCIS) for most of these units.

Instructional planning and evaluation based upon values goals differs in important ways from planning for knowledge and process goals in science. Experience and studies suggest, for example, that values arise and are formed in the process of learning and teaching--the classroom environment--and not necessarily from the direct teaching of values. In helping students acquire and strive to attain values, the educator relies upon teaching knowledge and skills that have a logical bearing upon these values. Where the teacher is concerned with the teaching of value clarification and formation processes, he or she teaches the nature and application of such conventional skills as verifying information, relating information to criteria, and other methods of clarifying personal and social values. Moreover, he or she is concerned that students acquire sufficient information to make informed judgments regarding public issues. To do this requires knowledge of the information and value positions used by proponents and opponents in defense of their respective views. At the end of this collection are stated some science-related issues which may be used to help students acquire information that will lead to better informed value positions.

We all need more information about values education and, therefore, reactions of readers to this section are especially solicited in accord with the Project's policy of seeking feedback to assist in improving and revising these volumes. The knowledge and process goals of the "disciplines" have already been revised as the basis of two years of experience with a critique edition but they too are open to further improvement.

How do program and course goals differ from behavioral and performance objectives?

While program and course goals specify general and specific measurable learning outcomes, the "behavioral objective" specifies the method of measurement as well as the desired behavior, and "performance objective" adds prerequisites and proficiency level.

The program and course goals provide explicit statements of possible learning outcomes which teachers and students can define and for which they can accept responsibility in ways most suitable to them. The teacher and student are free to select those methods for achieving outcomes which seem most promising in light of their resources and capabilities. This provides for more flexible teaching and learning than teaching systems based on behavioral and performance objectives. Such an approach places greater demands on the ingenuity and professionalism of teachers, but has far greater potential because of its consistency with motivational principles and its reliance on the judgment of the professional on the scene.

Where did the course goals come from?

The course goals were developed by outstanding teachers using available models and guides. This second edition of the science goals is a revision of a critique edition produced in the summer of 1971. The original writers and the revision committee were supported by tri-county and Oregon and Washington state curriculum and evaluation personnel and by selected university and public school consultants.

More than 55 local school districts in the tri-county area of metropolitan Portland are active in the Project. This has been achieved through the leadership of the intermediate education districts of the three counties. Representatives from Oregon school districts outside the metropolitan Portland area, from the states of Oregon and Washington, and from private school systems have also made valuable contributions.

Its broad base of participation strengthens the Project in a number of ways. First, it provides greater financial and personnel support than any single district could provide. Second, it makes it possible to draw upon a large and representative pool of teacher talent in organizing goal development committees. Third, it provides a widely representative testing ground for the theories and products of the Project. In less than two years, the critique edition of the science goal collection has been used extensively in curriculum development and evaluation projects of several state departments of education and of many local districts

What can the goals in this collection be used for?

School systems may use the collections to clarify the purposes of education for students, teachers, parents, and the community. This collection can be used as a basis for judging the comprehensiveness and adaptability of goals and objectives of local courses of study and textbooks. New learning possibilities can be formulated and discussed. Statements already produced or being considered as learning outcomes can be evaluated for conciseness, clarity and accuracy. These kinds of studies aimed at assuring agreement on goals and suggesting ways and means of attaining them can be undertaken by groups of teachers and support personnel from all levels of a school system or across grade levels, divisions, or high school departments or by individual teachers.

The project provides an important resource for improving the quality and extent of participation of students, parents, teachers, school boards, and other citizens in deciding the mission of the schools.

Another use of the collection is to provide a basis for teaching-learning evaluation and accountability. This use requires development of procedures within a school system for making a commitment to learning outcomes at the program and course levels. The goals of this collection provide a wide range of clearly stated goals from which choices can be made. Once a commitment is made (a process that may involve boards of education, administrators, teachers, students, and citizens), the educational mission of the system and of each teacher will be known and can be communicated. Methods of instruction and evaluation best suited to the goals agreed on can then be planned. Under no circumstances, however, should goals stated for planning and communication be misused to limit the teacher's freedom to respond to spontaneous opportunities for learning or be misapplied in the evaluation of teacher performance in terms of student performance.

Another use of the collection is the rewriting and development of courses and curricula. By making learning options explicit and sharable, the collection can sharpen the focus of curricular planning. One important example of curriculum development fostered by this collection is cross-disciplinary planning.

The goals, although printed in subject collections such as science, language arts, social science, mathematics, music, etc., may be related and grouped in and across subjects. Thus, for example, a teacher interested in teaching about "civilization" can locate goals dealing with related concepts in science, social science, language, mathematics, or other subject fields. Computerization of the goals is in process which will permit the retrieval of the goals by any one or more of the codes: subject category, educational level, types of knowledge and process, relation to career education goals, concepts and values dealt with, and index words. This system will facilitate efficient and sophisticated interdisciplinary planning.

Another use of this collection is for long-range planning and systematic control of educational development. The past few years in education have demonstrated that few results of experimentation and development are transportable. The inability of educators to define clear, unambiguous statements of desired learning outcomes is an important underlying cause. The Goal Development Project is establishing sets of goals that may be used consistently for instructional planning and evaluation. The stability this can provide educational experimentation and development is apparent. The power of the goal collections themselves in promoting good educational planning and the ease and convenience it affords teachers in that planning is equally evident.

In all of the above activities, and in those we have not cited, or even thought of, districts are invited and encouraged to use the collection selectively and to add their own goals wherever this collection is insufficient to their needs. We hope that where they do add and modify they will let us know and thus help us expand and improve the collection.

Will help be available for evaluating the attainment of the goals in this collection?

The principal measurement product under development by the Project is a set of measurement helps related to each course goal. This set is to be so comprehensive that any teacher who selects a course goal and translates it into one or more instructional goals will be able to retrieve items, or at least models of items, appropriate to assess the attainment of his instructional goals.

The Project has already defined evaluation models appropriate for assessment of goals in each of the classes of knowledge and process. These models will be used to guide both psychometricians and teachers in the development of criterion-referenced test items appropriate for measuring each type of knowledge and process. As soon as theoretical formulations relating to values, generalizations, and concepts are refined and consistent, similar work will begin in developing evaluation models and items for those classes of learning.

Is this the final version of the program and course goals?

No. In the development of both the program and the course goals, an effort was made to make them comprehensive, realistic, and immediately applicable to today's schools. At the same time, these goals and the taxonomy are to be revised and improved as they are subjected to use and scrutiny by teachers and curriculum personnel. Already suggestions from users and reviewers have resulted in major improvements over the earlier critique edition and minor but very useful improvements in this second printing of the second edition.

Future directions.

The twelve goal collections produced to date represent only a part of the goal-based planning, learning and evaluation system toward which we are working. Students, teachers, department and building administrators, area, state, and national educators, and parents and citizens are all increasingly concerning themselves with the definition of the outcomes of student learning. Our goal collections give all of the above persons a resource to help them define their goals. The collections help save time and help make the sets of goals developed at each level comprehensive.

What is needed yet and what we are now working toward include:

1. A system of multiple measurement items or at least models for each level of goal so that the person working toward a goal can select items which measure its attainment the way it has been taught and learned.
2. Transportable materials, models, and methods to help goal definers select and adapt and add to the existing collections to arrive at a clear, valid statement of their goals.
3. Transportable materials, models, and strategies to help the goal definers use the goals in needs assessment, materials selection, curriculum planning and development, instruction, evaluation, and accountability.

While we acknowledge the dangers in all this (pointed out by Stake, Combs, and others) of oversimplification and overmechanization, we believe those dangers can be avoided as we pursue the benefits of increasing communication among those involved in teaching and learning and support them in their efforts to deal with the infinite complexity of the teaching-learning process. Nowhere else is such a comprehensive and widely applicable and theoretically as well as practically valid resource for educational goal definition, goal attainment, and goal measurement being developed.

As time passes, new goals will be called for. For this reason a provision is being made for the continual review and revision of the goals. This will be largely dependent on feedback from the field. Thus, what is being created is a dynamic, open system for goal-based learning and evaluation.

How to read and interpret the materials in this goal collection.

Following this introduction there are four sets of indexes for retrieving course goals indicated by four different colors: science program goals, blue; career education program goals, green; knowledge and process classifications, yellow; and science subject matter taxonomy, pink. Numbers and/or letter codes on the course goals refer to the materials on the colored pages.

The bulk of the pages in this collection are taken up with the course goals themselves and their codes. Since our aim in these few pages is to learn how to read, interpret, and use these goals, let us look at and discuss a sample page of them from the science collection. Please refer to the following page.

Subject Matter Taxonomy Headings

The numbered heading(s) of the left hand column of each page of the course goals (e.g., 5. Physics, 5.4 Dynamics (causes of motion), and 5.4.4 Gravity) identify those sections (and possibly subsections) of the subject matter taxonomy under which the goals on this page are classified. The science taxonomy which is to be found on the pink pages in the front of the book thus serves as a specific and detailed table of contents for this collection of course goals. By looking through the science taxonomy, a user

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.4 Gravity (Cont.)						
6. The student knows that the acceleration due to gravity at any position above the earth is dependent upon the distance from the earth's center, the average density of the earth below, and the earth's rotation.	U H	K8	4		6.1.5	(C)Force (C)Motion
7. The student is able to compare the weights of objects by weighing them in his or her hands (qualitative comparison).	P I U H	P45	2		2.1.4.5	(C)Weight
8. The student is able to compare the weights of objects by weighing them on a scale (quantitative comparison).	P I U H	P45	2	5	2.1.4.5	(C)Weight (C)Measurement
9. The student is able to predict the variations in the weight of an object as measured at different distances from the center of the earth.	I U H	P51	2		2.1.5.1	(C)Weight (C)Change
10. The student knows ways in which acceleration due to the gravity of a an object may be determined.	U H	K2 K7	2			(C)Motion (C)Measurement
11. The student knows the accepted "working" values for acceleration due to gravity near the earth's surface (e.g., 32.2 feet per second squared, and 980 centimeters per second squared are accepted "working" values for the acceleration due to gravity near the earth's surface).	H	K2	4		6.1.5	(C)Motion (C)Measurement

can find what topics are covered and can turn to those in which he is interested.

The taxonomies also form a comprehensive but brief overview of the topics in each subject area judged important in K-12 curricula. As such, they form a valuable and convenient tool for curriculum and materials review and planning.

Course Goals

In the left most column under the heading "5.4.4 Gravity (Cont.)" are the Course Goals themselves. Some goals in this column may have a bracket to their left. The goals inside the bracket are logically related and may be viewed as a unit.

Level P/I/U/H (Primary, Intermediate, Upper and Higher)

This code provides an estimate of the grade level or levels at which the learning is appropriate. Many times the nature of the goal suggests continued learning over several levels in which case all levels involved are codes. These levels are approximate, for it is evident that the appropriate time for learning varies with the interests and abilities of students and the organization of the school.

Care should be taken not to confuse the use of level codes (P/I/U/H) in science, language arts, etc. to indicate grade level with the use of the same codes in other collections (e.g., business education) to indicate skill level.

Knowledge or Process Classifications

The classifications referred to are described at the front of the book on the yellow pages. All goals are roughly classified as knowledge or process, or values, depending upon whether they deal with something that the student is able to recall, something the student is able to do, or the student's value-attitude processes. All goals, therefore, begin with the words, "The student knows ..." or "The student is able to ..." or "The student values ...".

The familiar knowledge/process distinction is further subdivided into twelve knowledge (e.g., K8) and numerous process (e.g., P45) categories to which all course goals have been coded. The value goals have not yet been similarly classified and are simply coded as "V".

This detailed classifying of knowledge and process goals provides insight into teaching, measurement, and evaluation requirements. Work has already begun in analyzing types of measurement appropriate for each type of knowledge goal. This work will be extended to process learning as rapidly as resources permit.

Subject Area Program Goals

In this column we find the number of one or more of the science program goals found in the front of this book on the blue pages. This type of goal was discussed earlier. Here it is enough to recall that program goals are more general than course goals and that a set of program goals should constitute a description of the major learning outcomes expected from a program. Each course goal is cross coded to the number of the program goal(s) to whose attainment it is most directly related.

Career Education Program Goals

In this column we may find the code of one or more of the career education program goals found in the front of the book on the green pages.

Career education, as envisioned by the coders, concerns the total life of an individual, including life roles as a citizen, user of leisure, and family member as well as worker. Nearly every course goal bears at least an indirect relationship to career education viewed in that manner. Only those course goals, however, which have a "direct" relationship to a career education program goal have been coded to that program goal.

A "direct" relationship was interpreted to exist if a teacher could easily and naturally attach some career meaning to the instruction relating to that course goal and thus readily integrate the teaching of career education into the teaching of his subject. The restriction of the codings to direct relationships as just defined means that codings to career education program goals are relatively rare in the parts of the course goal collection dealing with the specific technical aspects of science.

A reader should not assume that because a course goal is cross coded to a career education program goal that he should make an effort to relate it to career education in every case. That is up to himself and the policies to which he is responsible. This coding provides suggestions, notprescriptions, for curriculum planning and teaching.

A teacher may use this coding as a help in integrating a discipline and career education and vice versa, by asking himself the following question: "When I am teaching this goal, is there some aspect of career education that can usefully and naturally be brought to the attention of my students?" The cross coding suggests that the answer is yes and what the aspect may be.

The career education code used with these goal collections makes them the first operational resource for "integrating career education and the rest of the curricula." Naturally a great deal of work has to be done to refine and extend the beginning which the present cross codings represent.

Other Related Content Taxonomy Headings

This code is provided since goals are often rightly classified under more than one subject heading. The numbers in this column refer again to the subject matter taxonomy on the pink pages at the front of the book.

(C)Concept/(V)Value Words

This form of code is one of the newest and potentially most useful ways to describe and retrieve sets of goals, especially for interdisciplinary learning. Words designating major concepts or values to which a goal relates directly are written beside that goal in this column. Words identifying concepts are preceded by "(C)" to distinguish them from the value words which are preceded by "(V)". Although explicitly singling out the concepts and values dealt with in goals is theoretically very interesting and useful, in practice it is very difficult since no valid lists of such concepts and values exist yet in the various subject areas. Such lists are being developed by the Project but meanwhile the concept and value word codings should be viewed as experimental and subject to change and refinement.

A final code is the Index Word. Although it does not appear on the printed pages, it is keyed to each goal for retrieval in much the way documents are coded for retrieval in the familiar ERIC retrieval system. Users will have available lists of index words by discipline and across disciplines. The index to the course goals found at the back of this book was generated from this code.

Conclusion

We have tried to make the collection of possible biological and physical science learning goals as valid and complete and useful as possible. Constructive criticism is welcomed by phone, word of mouth, carrier pigeon, etc. after you have discussed and tried out this resource in your district. Ultimately, the success of the Project is dependent upon you.

PROGRAM GOALS,
SCIENCE

PROGRAM GOALS

BIOLOGICAL AND PHYSICAL SCIENCE

1. The student values science as a way of learning and communicating about self, others, and the environment.

2. The student is able to use scientific problem-solving and inquiry processes.

3. The student is able to use the conventional language, instruments, and operations of science.

4. The student knows significant scientific assumptions, theories, principles, laws, facts, and their cultural and historical contexts.

5. The student is able to use scientific knowledge, processes, and conventions to clarify values, examine issues, solve personal and social problems, and to satisfy personal curiosity.

6. The student relates science learnings to the planning and fulfilling of personal, social, and career life roles.

7. The student values science for its aesthetic contribution to his continuing personal experience.

8. The student is able to initiate personally novel ideas related to science.

9. The student is confident of his or her right to develop, hold, or express conventional or unusual ideas related to science.

PROGRAM GOALS,
CAREER EDUCATION

PROGRAM GOALS

CAREER EDUCATION

1. The student knows the personal and social functions and importance of work and therefore values and respects workers.

2. The student knows the relationship of the life role of worker to other life roles of citizen, user of leisure time, and family member.

3. The student knows the physical, psychological, and educational requirements of various careers.

4. In making career decisions, the student knows and is able to weigh the significant factors including his or her: (a) interests, (b) aptitudes, (c) abilities, and (d) the implications of the decision alternatives for his life roles as a citizen, user of leisure, and family member.

5. The student is able to discover and learn the knowledge, skills, attitudes, and values necessary to carry out career decisions.

KNOWLEDGE
AND
PROCESS
CLASSIFICATIONS

27

-Knowledge Categories-

G1	Principles and Laws
G2	Simple Generalizations
K1	Conventions: Names and Nomenclature
K2	Conventions: Symbols, Rules, Standardized Processes, Definitions
K3	Properties, Parts, Characteristics, Features, Elements, Dimensions
K4	Trends and Sequences
K5	Similarities and Differences, Discriminations, Classifications
K6	Contexts, Locations, and Orientations
K7	Operations, Methods of Dealing with, Functions
K8	Cause and Effect Relationships (Costs and Benefits
K9	Criteria or Standards
K10	Non Cause-Effect Relationships

-Inquiry-Problem Solving Processes-

P1 Input — Acquiring Information

- P11 Viewing
- P12 Hearing
- P13 Feeling (tactile)
- P14 Smelling
- P15 Tasting
- P16 Using sense extenders
- P17 Using internal sensors of emotion

P2 Input Verification — Insuring Validity and Adequacy

- P21 Evaluating authoritativeness of sources
- P22 Evaluating logical consistency and accuracy
- P23 Evaluating relevance to desired learning purposes
- P24 Evaluating adequacy for acting or deciding (comprehensiveness and depth)

P3	Preprocessing		Organizing Information
		P31	Labeling, naming, numbering, coding
		P32	Recording, listing
		P33	Classifying, categorizing, grouping, selecting, according to criteria
		P34	Ordering, sequencing
		P35	Manipulating, arranging, transforming, computing
		P36	Estimating
		P37	Summarizing, abstracting
P4	Processing I		Interpreting Information (drawing meaning from data)
		P41	Decoding verbal and nonverbal symbols (reading and literal translating)
		P42	Inferring, interpolating, extrapolating
		P43	Analyzing
		P44	Associating, relating, equating
		P45	Comparing, contrasting, discriminating
		P46	Synthesizing
		P47	Testing against standards or criteria
		P48	Generalizing
P5	Processing II		Using Information to Produce New Information
		P51	Theorizing, predicting
		P52	Formulating hypotheses
		P53	Testing hypotheses
		P54	Revising hypotheses
P6	Output I		Acting on the Basis of Information
		P61	Reacting
		P62	Making decision
		P63	Solving problems
		P64	Restructuring values (adapting, modifying)
		P65	Restructuring behavior (adapting, modifying)
		P66	Encoding verbal and nonverbal symbols prior to communication
		P67	Creating on the basis of knowledge and process
P7	Output II		Communicating Information
		P71	Vocalizing (nonverbal)
		P72	Gesturing, moving
		P73	Touching
		P74	Speaking
		P75	Writing
		P76	Using art media (painting, drawing, sculpting, constructing, etc.)
		P77	Dramatizing
		P78	Singing, playing instruments
		P79	Dancing

SCIENCE
TAXONOMY

SCIENCE TAXONOMY

Page

1. Values and science 1

  1.1 Value clarification 1

    1.1.1 Identifying personal values (See also 2.1.6.1) . . . 3

    1.1.2 Assessing intensity of personal values 5

    1.1.3 Analyzing rationales: questioning 6

      1.1.3.1 Analyzing statements 8

      1.1.3.2 Analyzing issues 9

      1.1.3.3 Using interpersonal communication 11

    1.1.4 Analyzing value origins and functions 12

    1.1.5 Identifying basic needs: personal, societal 13

    1.1.6 Prioritizing needs 14

    1.1.7 Matching values to needs 15

  1.2 Valuing the conditions that promote scientific inquiry. . . 16

    1.2.1 Societal conditions 16

    1.2.2 Personal conditions 18

      1.2.2.1 Valuing personal development: intellectual, moral, social 18

      1.2.2.2 Valuing information 23

  1.3 Valuing the processes of scientific inquiry (see parallel categories in 2.1) 24

    1.3.1 Acquiring information 24

    1.3.2 Validating information 26

    1.3.3 Organizing information 28

    1.3.4 Processing information: interpreting 29

    1.3.5 Producing new information 31

    1.3.6 Acting on the basis of information 32

Page

1.3.7 Communicating information 34

1.4 Valuing the uses of science in meeting human needs 36

1.4.1 Personal needs 36

1.4.2 Societal needs 38

2. Processes and science 40

2.1 Universal inquiry-problem solving processes 40

2.1.1 Acquiring information 40

2.1.1.1 Perceiving, experiencing 41

2.1.1.2 Locating and using resources (see also 7.3.1) 50

2.1.2 Insuring validity and accuracy of information . . . 54

2.1.2.1 Evaluating authoritativeness of sources . . 57

2.1.2.2 Evaluating logical consistency and accuracy 58

2.1.2.3 Evaluating relevance to purposes or objectives 61

2.1.2.4 Evaluating adequacy for acting or deciding (see also 2.1.6) 62

2.1.3 Organizing information 65

2.1.3.1 Labeling, naming, numbering, coding 66

2.1.3.2 Recording, listing 67

2.1.3.3 Classifying, categorizing, grouping, selecting according to criteria (see also 3.2.3.1) 68

2.1.3.4 Ordering, sequencing 72

2.1.3.5 Manipulating, arranging, transforming, computing 73

2.1.3.6 Estimating 76

2.1.3.7 Summarizing, abstracting 78

2.1.4 Interpreting information 79

Page

2.1.4.1 Decoding verbal and nonverbal symbols (see also 7.) 80

2.1.4.2 Inferring, interpolating, extrapolating . . 82

2.1.4.3 Analyzing 84

2.1.4.4 Associating, relating, equating 86

2.1.4.5 Comparing, contrasting, discriminating, measuring 89

2.1.4.6 Synthesizing 92

2.1.4.7 Testing against standards or criteria . . . 94

2.1.4.8 Generalizing 97

2.1.5 Using information to produce new information 99

2.1.5.1 Scientific method 100

2.1.5.2 Problem solving models 105

2.1.6 Acting on the basis of information--decision making. 110

2.1.6.1 Restructuring values 111

2.1.6.2 Restructuring behavior 112

2.1.6.3 Encoding verbal and nonverbal symbols prior to communication 114

2.1.6.4 Creating on the basis of knowledge and process 115

2.1.7 Communicating information 117

2.1.7.1 Giving information (see also 2.1.6.3) . . . 118

2.1.7.2 Exchanging information 119

2.1.7.2.1 Identifying communication problems 119

2.1.7.2.2 Using communication skills . . . 122

2.1.7.3 Using communication systems 127

2.2 Conventional science processes 128

2.2.1 Measuring/quantifying 131

Page

2.2.1.1 Measuring length 133
2.2.1.2 Measuring area 136
2.2.1.3 Measuring volume 137
2.2.1.4 Measuring angles 140
2.2.1.5 Measuring time 142
2.2.1.6 Measuring mass 144
2.2.1.7 Measuring energy 146
2.2.1.8 Measuring power 148
2.2.1.9 Measuring charge 149
2.2.1.10 Measuring electrical potential 150
2.2.1.11 Measuring force 151
2.2.1.12 Measuring weight 153
2.2.1.13 Measuring temperature 154
2.2.1.14 Measuring information (see also 5.17) . . . 156
2.2.2 Using equipment 158
2.2.2.1 Sense extenders 159
2.2.2.2 Laboratory equipment 162
2.2.2.3 Data processing equipment 164
2.2.3 Using scientific vocabulary 165
2.2.4 Using models 168
2.2.5 Using mathematics (including statistics) 171
3. Biology 173
3.1 The cell 173
3.1.1 Organisms are composed of cells 174
3.1.1.1 Basic building blocks 174
3.1.1.2 Building an organism 175

Page

3.1.2 Structure of the cell 176

3.1.2.1 General cell structure 176

3.1.2.2 Relationship of structure to function . . . 178

3.1.3 Function of the cell 180

3.1.3.1 General cell function 180

3.1.3.2 Transport of cellular material 181

3.1.3.3 Cell metabolism 182

3.1.3.3.1 Plants 185

3.1.3.3.2 Animals 188

3.1.3.4 Cell responses 189

3.1.3.5 Concept of the gene 190

3.1.4 Specialized cells 194

3.2 The organism 195

3.2.1 Structure of the organism 196

3.2.1.1 Organs and complex tissues 200

3.2.1.1.1 Organs and complex tissues--plants 202

3.2.1.1.2 Organs and complex tissues--animals 204

3.2.1.2 Organ and tissue systems 211

3.2.1.2.1 Organ and tissue systems--plants 213

3.2.1.2.2 Organ and tissue systems--animals 215

3.2.2 Function of the organism 217

3.2.2.1 General function of parts of an organism. . 217

3.2.2.2 Regulation in organisms 220

3.2.2.3 Reproduction and development 223

Page

3.2.2.3.1 Reproduction and development--plants 227

3.2.2.3.2 Reproduction and development--animals 231

3.2.2.4 Coordination and behavior 235

3.2.3 Classification 241

3.2.3.1 Classification systems 241

3.2.3.2 Taxonomic groups and characteristics . . . 246

3.2.3.3 Other groupings and characteristics 248

3.2.4 Human biology 252

3.2.4.1 Structure and function 252

3.2.4.2 Human genetics 257

3.2.4.3 Human behavior 258

3.2.4.4 Health and hygiene 260

3.3 Populations of organisms 266

3.3.1 Dynamics 267

3.3.1.1 Growth 267

3.3.1.2 Mortality 269

3.3.2 Regulation 270

3.3.2.1 Internal control 270

3.3.2.2 External control 271

3.3.3 Population genetics 272

3.4 Natural systems 273

3.4.1 Natural environment (see also 6.3.5) 274

3.4.2 The community 278

3.4.3 Ecosystem 280

Page

3.4.3.1 General aspects 280
3.4.3.2 Cycles and flow 283
3.4.3.3 Regulation 288
3.4.4 Biome 289
3.4.5 Biosphere 290
3.4.6 Change through time 291
3.4.6.1 Origin of life 291
3.4.6.2 Change in existing organisms 292
3.5 Human influence on natural systems 295
3.5.1 Physical changes 296
3.5.1.1 Atmosphere (see also 6.3.5.3) 296
3.5.1.2 Soil (see also 6.3.5.1) 299
3.5.1.3 Water (see also 6.3.5.2) 301
3.5.2 Biological changes 304
3.5.3 Consequences of change 306
4. Chemistry 312
4.1 Matter 312
4.1.1 Characteristics 313
4.1.1.1 Mass 315
4.1.1.2 Volume 316
4.1.1.3 Density 317
4.1.2 Structure 318
4.1.2.1 Atoms 318
4.1.2.2 Ions 322
4.1.3 Bonding 323
4.1.4 Molecules 324

Page

4.1.4.1 Elements 325
4.1.4.2 Compounds 328
4.2 States of matter 330
4.2.1 Gases 332
4.2.2 Liquids 336
4.2.3 Solids 338
4.2.3.1 Crystal 339
4.2.3.2 Amorphous 340
4.3 Solutions 341
4.3.1 Electrolytes 345
4.3.1.1 Acids and bases 346
4.3.1.2 Electrochemistry 348
4.3.2 Nonelectrolytes 350
4.3.3 Colloids 351
4.4 Kinetics 353
4.5 Equilibrium 355
4.6 Thermochemistry 357
4.7 Oxidation--reduction 360
4.8 Spectroscopy 362
4.9 Nuclear chemistry 363
4.10 Photochemistry 368
4.11 Organic chemistry 369
5. Physics 372
5.1 Fundamental physical quantities 372
5.1.1 Characteristics 373
5.1.2 Mass 375

Page

5.1.3 Length 376

5.1.4 Time 377

5.2 Vectors and scalars 378

5.2.1 Characteristics 379

5.2.2 Representations 380

5.2.3 Scalar and vector mathematical operations 381

5.3 Kinematics (motion) 382

5.3.1 Characteristics 383

5.3.2 Speed 385

5.3.3 Rectilinear velocity (straight-line velocity) . . . 386

5.3.4 Rectilinear acceleration (straight-line acceleration) 388

5.3.5 Trajectory motion 390

5.3.6 Circular motion 391

5.4 Dynamics (causes of motion) 392

5.4.1 Characteristics 393

5.4.2 Forces 394

5.4.3 Friction 397

5.4.4 Gravity 398

5.4.5 Moment of a force 401

5.4.6 Impulse and momentum 402

5.5 Mechanical energy 404

5.5.1 Characteristics 405

5.5.2 Work 406

5.5.3 Kinetic energy 407

5.5.4 Potential energy 408

5.5.5 Conservation of energy 409

Page

5.6 Machines 410

5.6.1 Characteristics 411

5.6.2 Simple machines 412

5.6.3 Levers and balances 413

5.7 Frames of reference 416

5.7.1 Characteristics 417

5.7.2 Relative quantities 419

5.8 Properties of matter 421

5.8.1 Characteristics 422

5.8.2 Solids, liquids, and gases 424

5.8.3 Elasticity 427

5.8.4 Simple harmonic motion (repeating motion) 429

5.8.5 Hydrostatics (fluids at rest) 431

5.8.6 Hydrodynamics (fluids in motion) 434

5.8.7 Surface phenomena of liquids 435

5.9 Heat and thermodynamics 437

5.9.1 Characteristics 438

5.9.2 Temperature 440

5.9.3 Thermal expansion and contraction 442

5.9.4 Quantity of thermal energy 445

5.9.5 Change of state 447

5.9.6 Transfer of heat 451

5.9.7 Thermodynamics 455

5.10 Waves 456

5.10.1 Characteristics 457

5.10.2 Rectilinear (straight-line) propagation (travel) . . 461

5.10.3 Reflection 462

Page

5.10.4 Refraction 464

5.10.5 Diffraction 465

5.10.6 Interference of waves 466

5.11 Light (electromagnetic radiation) 468

5.11.1 Characteristics 469

5.11.2 Shadows 473

5.11.3 Photometry 474

5.11.4 Reflection 476

5.11.5 Refraction 480

5.11.6 Color 485

5.11.7 Interference 489

5.11.8 Diffraction 491

5.11.9 Polarization 492

5.11.10 Photoelectric effect 493

5.11.11 Lasing effect 496

5.12 Sound 498

5.12.1 Characteristics 499

5.12.2 Transmission of sound 502

5.12.3 Reflection and absorption of sound 503

5.12.4 Intensity (loudness) 504

5.12.5 Frequency (pitch) 506

5.12.6 Harmonic content of sound (quality) 509

5.13 Electricity 512

5.13.1 Characteristics 513

5.13.2 Static electricity (electrostatics) 515

5.13.3 Electrical forces. 517

5.13.4 Potential difference 518

Page

5.13.5 Capacitance 520

5.13.6 Electric current 523

5.13.7 Electric circuits 526

5.13.8 Electrical energy 531

5.14 Magnetism 533

5.14.1 Characteristics 534

5.14.2 Magnetic domains 538

5.14.3 Magnetic forces 540

5.14.4 The earth's magnetism 542

5.14.5 Electromagnetism 544

5.14.6 Electromagnetic induction 546

5.14.7 Generators and motors 549

5.14.8 Inductance 553

5.14.9 Alternating current (AC) circuits 557

5.15 Atomic physics 563

5.15.1 Characteristics 564

5.15.2 Subatomic particles 566

5.15.3 Spectra of atoms 570

5.16 Nuclear physics 572

5.16.1 Characteristics 573

5.16.2 Nature of radioactivity 574

5.16.3 Nuclear reactions 576

5.16.4 Nuclear energy use 578

5.17 Information 580

5.18 Forefronts of physics 585

Page

6. Earth and space sciences 588
  6.1 Astronomy 588
    6.1.1 History of astronomy 588
    6.1.2 Stellar system 590
      6.1.2.1 Theories of origin 591
      6.1.2.2 Galaxies. 592
      6.1.2.3 Constellations 594
      6.1.2.4 Nebulae 595
      6.1.2.5 Stars 596
    6.1.3 Solar system 600
      6.1.3.1 Theories of origin 601
      6.1.3.2 The sun 602
      6.1.3.3 The planets 609
        6.1.3.3.1 The earth 609
        6.1.3.3.2 Other planets 616
      6.1.3.4 Satellites 618
        6.1.3.4.1 Natural 618
        6.1.3.4.2 Artificial 621
      6.1.3.5 Comets 623
      6.1.3.6 Meteoroids and asteroids 624
    6.1.4 Tools of astronomy 625
      6.1.4.1 Astronomical measurements 626
      6.1.4.2 Astronomical instruments 628
    6.1.5 Dynamics (forces, motion, and time) (see also 5.4) . 629
    6.1.6 Space travel 634

Page

6.2 Meteorology 636

6.2.1 History of meteorology 637

6.2.2 Origin and structure of atmosphere 638

6.2.3 Heating and cooling (see also 5.9) 642

6.2.4 Moisture 645

6.2.4.1 Humidity 646

6.2.4.2 Water cycle (see also 4.2) 647

6.2.4.3 Clouds and fog 648

6.2.4.4 Precipitation 649

6.2.5 Storms 650

6.2.5.1 Air masses and fronts 651

6.2.5.2 Violent storms. 652

6.2.6 Winds 653

6.2.7 Climate 657

6.2.8 Weather forecasting. 659

6.2.9 Weather control 662

6.3 Geology 663

6.3.1 History of geological sciences 663

6.3.2 Earth's structure (physical geology) 665

6.3.2.1 Interior 666

6.3.2.2 Crust 667

6.3.2.3 Surface features 668

6.3.2.4 Minerals 670

6.3.2.5 Rocks 674

6.3.2.6 Soils (see also 6.3.5.1) 681

6.3.3 Geologic processes (physical geology) 683

Page

6.3.3.1 Vulcanism 684

6.3.3.2 Crustal movements 686

6.3.3.3 Weathering, erosion, deposition (see also 6.3.5) 691

6.3.4 Earth's history (historical geology) 699

6.3.4.1 Geologic time 700

6.3.4.2 Evolution and variation (see also 3.3.3, 3.4.6) 702

6.3.4.3 Fossils 705

6.3.4.4 Methods of dating 709

6.3.5 Earth environments (environmental geology) (see also 3.4, 3.5) 710

6.3.5.1 Soil 711

6.3.5.2 Water 715

6.3.5.3 Air 718

6.3.6 Tools of geologists 719

6.3.7 Applications of geologic science 722

6.3.7.1 Related sciences 722

6.3.7.2 Economic uses (see also 8.1). 723

6.4 Oceanography 724

6.4.1 History of oceanography 724

6.4.2 The ocean basins (see also 6.3.2.3) 726

6.4.3 The ocean waters 730

6.4.3.1 Composition and properties of seawater . . 730

6.4.3.2 Ocean layers and zones 732

6.4.4 Ocean movements 733

6.4.4.1 Circulation and currents 733

6.4.4.2 Tides 735

Page

6.4.4.3 Waves 737

6.4.5 Shorelines 739

6.4.5.1 Types of shorelines 739

6.4.5.2 Shoreline processes (see also 6.3.3.3). . . 740

6.4.5.3 Estuaries and bays 742

6.4.6 Life in the oceans 745

6.4.6.1 Distribution 745

6.4.6.2 Marine organisms 747

6.4.6.3 Marine ecosystems and processes (see also 3.4.3) 749

6.4.6.4 Effects of human activities (see also 3.5). 750

6.4.7 Tools of oceanography 752

6.4.8 Applications of oceanography 755

6.4.8.1 Related sciences 755

6.4.8.2 Economic uses (see also 8.1) 756

7. Reading and science 758

7.1 Foundation competencies for reading science 758

7.1.1 Establishing purpose 759

7.1.2 Building scientific vocabulary 760

7.1.2.1 Word attack 761

7.1.2.2 Word meaning 762

7.1.3 Adjusting rate to purpose 763

7.2 Comprehension of scientific literature 764

7.3 Research, reference, study skills 768

7.3.1 Location of resources (see also 2.1.1.2) 768

7.3.2 Organizing material (see also 2.1.3) 770

7.3.3 Evaluating information (see also 2.1.2). 771

46

Page

8. Science and career education 773

8.1 Science in careers 773

8.2 Career opportunities in science 774

8.2.1 Biological sciences 777

8.2.2 Chemistry 778

8.2.3 Physics 780

8.2.4 Earth/space science. 781

8.2.5 New or interdisciplinary sciences 782

8.3 Career requirements in science 784

8.3.1 Professional careers 784

8.3.2 Paraprofessional careers 786

8.3.3 Nonprofessional careers 788

8.4 Sources of career training 789

8.4.1 Professional training 789

8.4.2 Paraprofessional training 790

8.4.2.1 Public schools (K-12) 790

8.4.2.2 On-the-job training or apprenticeship . . . 791

8.4.2.3 Military services 792

8.4.2.4 Community colleges 793

8.5 Locating specific jobs or training programs 794

8.5.1 Government agencies or services 794

8.5.1.1 Employment offices 794

8.5.1.2 Court system 795

8.5.1.3 Welfare agencies 796

8.5.1.4 Military services (including VA). 797

8.5.1.5 Government publications 798

Page

8.5.2 Private employment agencies 799

8.5.3 Advertisements and directories 800

8.5.4 School placement services 801

8.5.5 Special interest organizations 802

48

COURSE GOALS

SCIENCE

1. Values and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1 Value clarification						
1. The student values the ability to make rational and informed judgments, choices, and decisions.	P I U H	V	1	4 5	2.1.2 2.1.6	(V)Judgment
2. The student values behavior based on rational and informed judgments, choices, and decisions.	P I U H	V	1	4 5	2.1.6	(V)Judgment
3. The student knows that rational and informed judgments, choices, decisions, and actions require full and accurate knowledge of a situation and of the values he or she brings to that situation.	P I U H	K9	4	4 5	2.1.6	(V)Judgment
4. The student values scientific knowledge and processes which are needed to validate information about situations.	P I U H	V	1	3 4 5	2.1.2 2.1.5	(V)Inquiry (V)Problem solving
5. The student values scientific knowledge and processes needed to validate information about values.	P I U H	V	1	4 5	2.1.2 2.1.5	(V)Inquiry (V)Problem solving
6. The student values an ever-increasing clarification of one's personal values, their causes and effects.	P I U H	V	1	4 5	2.1.6	(V)Self-knowledge
7. The student knows what things, ideas, and behaviors he or she values.	P I U H	K5	4	4 5	2.1.6.1	(V)Self-knowledge

SCIENCE

1. Values and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1 Value clarification (Cont.)						
8. The student knows how much he or she values things, ideas, and behaviors in relation to other things, ideas, and behaviors.	P I U H	K5	4	4 5	2.1.6.1	(V)Self-knowledge
9. The student knows the reasons he or she values certain things, ideas, and behaviors (e.g., what needs they satisfy, what perceptions, facts, principles, or assumptions support them).	I U H	K9	4	4 5	2.1.6.1	(V)Self-knowledge
10. The student knows that different individuals value different things, ideas, and behaviors to satisfy essentially similar basic needs.	I U H	G2 K5 K8	4	4 5	2.1.6.1	(V)Respect for others
11. The student is able to evaluate the appropriateness of his or her values and behavior to meet personal needs, the needs of other individuals, and the needs of society.	U H	P22 P24	2	4 5	2.1.6.1	(V)Self-knowledge
12. The student knows that problems encountered by individuals may create or reveal conflicts in personal values that cause behavior to deviate from usual patterns.	I U H	K8 K10	4	4 5	2.1.6.1	(C)Behavior (V)Understanding
13. The student is able to use scientific knowledge and processes to resolve conflicts in personal values.	P I U H	P65	2	4 5	2.1.5 2.1.6.1	
14. The student is able to modify or restructure values and behavior in response to increasing knowledge of situations and self.	P I U H	P64 P65	2	4 5	2.1.6.1 2.1.6.2	(V)Self-knowledge

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.1 Identifying personal values (see also 2.1.6.1 Restructuring values)						
1. The student knows devices (i.e., activities, models, exercises, instruments, procedures, strategies) developed to aid in identifying personal values.	P I U H	K2 K7	3 4	4 5	2.1.5	(V)Resourcefulness
2. The student is able to select and use effectively aids recognizing and identifying his or her own values (e.g., role playing, attitude checklists, "Chairs" and other exercises developed by Simon, Raths, et al).	I U H	P33 P65	2 3	4 5	2.1.5 2.1.7.2	(V)Self-knowledge (V)Resourcefulness (V)Objectivity
3. The student is able to recognize values expressed in real or simulated behavior.	P I U H	P33 P42	2	4 5	2.1.6.2	(C)Behavior (V)Self-knowledge (V)Objectivity
4. The student is able to recognize values expressed in real or simulated choices.	P I U H	P33 P42	2	4 5		(V)Self-knowledge (V)Decision making (V)Judgment
5. The student is able to identify values and value principles through analysis of his or her own statements.	I U H	P33 P42	2	4 5		(V)Self-knowledge (V)Judgment (V)Objectivity

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.1 Identifying personal values (Cont.)						
6. The student is able to recognize values underlying his/her own decisions on real or simulated issues.	P I U H	P33 P42	2	4 5		(V)Self-knowledge (V)Decision making (V)Judgment (V)Objectivity
7. The student is able to recognize values underlying his/her interests.	P I U H	P33 P42	2	4 5		(V)Self-knowledge (V)Objectivity
8. The student is able to use appropriate terms to identify or describe recognized values.	P I U H	P66	2 3	4 5	2.1.7.2	(V)Self-knowledge (V)Accuracy

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.2 Assessing intensity of personal values (see also 2.1.6.1 Restructuring values)						
1. The student knows aids to recognizing, comparing, or estimating the intensity of a value or values (e.g., activities, models, scales).	P I U H	K2 K7	3 4	4 5	2.1.5	(V)Self-knowledge (V)Resourcefulness (V)Objectivity
2. The student is able to locate and use appropriate aids for recognizing, comparing, or estimating the intensities of values.	I U H	P33	2 3	4 5		(V)Self-knowledge (V)Resourcefulness (V)Objectivity
3. The student knows meanings of terms used in comparing or estimating relative intensities of values (e.g., ranking, prioritizing).	P I U H	K2	3 4	4 5		(V)Self-knowledge (V)Resourcefulness (V)Objectivity
4. The student knows that the strength of one's commitment to a value is expressed in one's behavior.	P I U H	G2 K8	4	4 5		(C)Behavior (V)Self-knowledge (V)Understanding
5. The student is able to identify actions, emotional responses, choices, and decisions which indicate the strength of his or her commitment to a value.	P I U H	P33	2	4 5	2.1.5	(V)Self-knowledge (V)Judgment (V)Decision making
6. The student is able to rank or prioritize personal values.	P I U H	P34 P64	2 3	4 5		(V)Self-knowledge (V)Judgment

1. Values and science
1.1 Values clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.3 Analyzing rationales: questioning (see also 2.1.2 Insuring validity and accuracy of information)						
1. The student values knowledge of the principles, assumptions, and generalizations which support his or her identified values.	P I U H	V	1	4 5	2.1.4.8	(V)Self-knowledge (V)Objectivity (V)Rationality
2. The student knows that analysis of value rationales is an open-ended process (each supporting statement requires its own support or justification).	I U H	G2 K3	4	4 5		(V)Self-knowledge (V)Organization (V)Rationality
3. The student is able to use logical operations and appropriate strategies, models, etc. in analyzing or questioning rationales.	I U H	P65	2 3	4 5	2.1.5	(V)Rationality
4. The student is able to examine critically the use of abstract value words by himself and others (e.g., rights, should, good, bad).	I U H	P22 P43 P63	2 3	4 5	2.1.4 2.1.5.2	(V)Rationality (V)Judgment
5. The student values inquiry into the feelings, facts, principles, assumptions, and generalizations which support one's own values (self-questioning).	I U H	V	1	4 5	2.1.5.2	(V)Curiosity (V)Self-knowledge (V)Rationality (V)Judgment (V)Objectivity

1. Values and science
1.1 Values clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.3 Analyzing rationales: questioning (Cont.)						
6. The student knows principles and purposes of common questioning procedures (e.g., adversary questioning, Socratic method, Gallagher's questioning strategies).	U H	K2 K3	3 4	4 5	2.1.5.2	(V)Rationality (V)Problem solving
7. The student is able to select and use appropriate questioning strategies and procedures to reveal feelings, facts, principles, assumptions, and generalizations which support values.	U H	P33 P63	2 3	4 5	2.1.5.2	(V)Resourcefulness (V)Problem solving (V)Self-knowledge (V)Accuracy
8. The student is able to formulate logical and relevant questions when analyzing or questioning value rationales.	P I U H	P22 P23	2	4 5	2.1.5.2	(V)Rationality (V)Problem solving (V)Accuracy

1. Values and science
1.1 Value clarification
1.1.3 Analyzing rationales: questioning

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.3.1 Analyzing statements (see also 2.1.2 Insuring validity and accuracy of information, and 2.1.4.3 Analyzing)						
1. The student is able to distinguish between value statements (opinions, ratings, judgments, etc.) and descriptive or definitional statements.	I U H	P45	2 3	4 5		(V)Judgment (V)Discrimation (V)Objectivity (V)Rationality
2. The student knows meanings of terms used to identify parts and kinds of statements, processes, and concepts in a value analysis model (e.g., rating, value object, value term, description, feature, characteristic).	U H	K2	3 4			(V)Judgment (V)Discrimination (V)Objectivity (V)Accuracy
3. The student is able to use terms, principles, and processes of formal logic in analyzing value statements and their rationales.	U H	P65	2 3		2.1.5.2	(V)Rationality (V)Objectivity (V)Judgment (V)Discrimination
4. The student is able to select and use models, definitions, procedures, and instruments developed to aid in the analysis of statements.	U H	P33 P63	2			(V)Resourcefulness (V)Rationality (V)Objectivity (V)Judgment (V)Discrimination

1. Values and science
1.1 Value clarification
1.1.3 Analyzing rationales: questioning

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.3.2 Analyzing issues (see also 2.1.5.2 Problem solving models, and Appendix I)						
1. The student is able to identify the different value positions represented in a social issue.	I U H	P33	2	4		(V)Discrimination (V)Social sensitivity
2. The student is able to identify facts, feelings, and logical principles supporting different value positions on an issue.	I U H	P33	2 3	4		(V)Discrimination (V)Social sensitivity (V)Respect for others
3. The student is able to identify factual and definitional problems to be resolved in making judgments or decisions on issues.	I U H	P33 P63	2 3	4		(V)Problem solving (V)Decision making (V)Judgment
4. The student is able to locate information which substantiates different value positions on social issues.	I U H	P33	2 3	4	2.1.1.2 7.3	(V)Knowledge (V)Objectivity (V)Inquiry (V)Resourcefulness (V)Accuracy (V)Judgment (V)Discrimination
5. The student is able to weigh the merits of information supporting value positions in terms of relevant criteria (e.g., relevance, authoritativeness, completeness, accuracy).	I U H	P21 P22 P23 P24 P63	2 3	4	2.1.2	(V)Objectivity (V)Judgment (V)Rationality (V)Discrimination (V)Problem solving (V)Decision making

SCIENCE

1. Values and science
1.1 Value clarification
1.1.3 Analyzing rationales: questioning

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.3.2 Analyzing issues (Cont.)						
6. The student is able to select and use an appropriate model to aid in the analysis of the rationales supporting value positions on personal or social issues.	U H	P33 P65	2 3	4	2.1.5.2 2.1.7.2	(V)Resourcefulness (V)Objectivity (V)Discrimination (V)Judgment (V)Rationality (V)Problem solving (V)Decision making

SCIENCE

1. Values and science
1.1 Value clarification
1.1.3 Analyzing rationales: questioning

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.3.3 Using interpersonal communication (see also 2.1.7.2 Exchanging information)						
1. The student is able to use interpersonal communications skills to clarify his or her understanding of the assumptions and principles of others.	P I U H	P65 P71 P72 P74	2 3	2 4 5		(V)Respect for others (V)Interpersonal relations (V)Understanding (V)Problem solving (V)Judgment (V)Communication
2. The student is able to use information from others to clarify his or her assumptions and principles.	P I U H	P41 P65	2	4 5		(V)Self-knowledge (V)Problem solving (V)Objectivity

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.4 Analyzing value origins and functions						
1. The student values knowledge of the origins and functions of his or her own values and value system.	I U H	V	1	4 5		(V)Self-knowledge
2. The student values scientific data, definitions, principles and theories which contribute to our growing knowledge of human value systems (e.g., from biological, behavioral, systems, information, and communications sciences).	I U H	V	1	4 5		
3. The student knows operational models or theories which facilitate analysis of value origins and functions.	U H	K2	3 4	4 5	2.1.5.2	(V)Self-knowledge (V)Resourcefulness
4. The student knows current scientific premises about the relationship of values to basic human needs, developmental processes, knowledge and behavior.	U H	K10	3 4	2 4 5	3.2.2.4 3.2.4.3	(C)History of science (C)Behavior (V)Self-knowledge (V)Knowledge
5. The student knows meanings of terms used in analysis of value origins and functions (e.g., basic needs, behavior, information processing, communication, feedback, conditioning, socialization).	U H	K2	3 4	2 4 5		(C)Behavior (V)Accuracy
6. The student is able to select and use appropriate strategies, instruments, models, etc. to facilitate analysis or increase knowledge of the origins and functions of his or her own values.	U H	P33 P65	2 3	2 4 5	2.1.5.2 2.2.4	(V)Self-knowledge (V)Resourcefulness (V)Objectivity

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.5 Identifying basic needs: personal, societal						
1. The student values scientific data and interpretations which aid in identifying physiological and psychological needs common to all humans.	I U H	V	1		3.2.4	(V)Inquiry (V)Unity (V)Knowledge (V)Self-knowledge
2. The student knows that some currently validated research indicates a hierarchy of human needs, with an individual's needs varying according to the level of psychological development and the external conditions or circumstances (see Appendix II).	U H	G2 K3	4			(C)History of science (C)Behavior (V)Self-knowledge (V)Knowledge
3. The student knows that some current scientific theories identify relationships between values and unmet personal or societal needs (see Appendix II).	U H	G2 K8 K10	4			(V)Self-knowledge
4. The student is able to locate and use appropriate exercises and instruments to aid in identifying the needs which underly and govern his or her own values and behavior.	U H	P33 P63	2 3	4 5	3.2.4	(V)Self-knowledge (V)Resourcefulness
5. The student values scientific knowledge and processes which aid in identifying basic needs of societies.	I U H	V	1			(V)Social concern (V)Social sensitivity (V)Quality of life
6. The student is able to select and use appropriate exercises and instruments to aid in identifying the unmet needs of societies.	U H	P33 P65	2 3		2.1.5.2	(V)Social concern (V)Social sensitivity (V)Quality of life (V)Resourcefulness

SCIENCE

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.6 Prioritizing needs						
1. The student is able to select and use appropriate exercises and instruments to aid in prioritizing personal or societal needs (e.g., listing in order of importance within a situation).	U H	P33 P34 P63	2 3	4 5		(V)Judgment (V)Discrimination (V)Social sensitivity

1. Values and science
1.1 Value clarification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.1.7 Matching values to needs						
1. The student is able to employ logical operations and appropriate devices to evaluate the adequacy and relevance of his or her values to satisfy identified needs.	U H	P64	2 3	4 5	2.1.2 2.1.5.2	(V)Rationality (V)Problem solving (V)Resourcefulness (V)Judgment (V)Self-direction
2. The student knows ways in which values serve needs.	U H	K8	4	4 5		
3. The student is able to restructure values in response to validated information about needs, values, and behaviors.	U H	P64	2 7 9	4 5	2.1.6.1	(V)Rationality (V)Judgment (V)Problem solving (V)Self-direction (V)Self-discipline (V)Self-respect (V)Self-confidence (V)Consistency

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.1 Societal conditions						
1. The student values a society committed to the continual expansion of human knowledge.	P I U H	V	1	1		(V)Quality of life (V)Commitment (V)Knowledge
2. The student values a society which provides freedom to inquire, so that completeness of information is not limited by authorities or by societal norms.	P I U H	V	1	1		(V)Inquiry (V)Freedom (V)Quality of life
3. The student values a society which provides resources to inquire (e.g., time free from survival tasks, means of storing and retrieving data, means of communicating information).	P I U H	V	1	1		(V)Inquiry (V)Quality of life
4. The student values a society which provides each member with knowledge and skills necessary to acquire, process, and use information to the fullest extent of his or her abilities.	P I U H	V	1			(V)Education (V)Inquiry (V)Quality of life (V)Participation (V)Individuality (V)Respect for others (V)Fulfillment
5. The student values a society which provides freedom to express and communicate facts, ideas, and opinions.	P I U H	V	1			(V)Freedom of expression
6. The student values a society in which means of communicating are generally available (including hardware such as telephone, television, printing, photography).	P I U H	V	1			(V)Communication

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.1 Societal conditions (Cont.)						
7. The student values a society characterized by general knowledge and use of diverse communication forms and systems (e.g., language, mathematics, graphic representations, art forms, technological systems).	P I U H	V	1			(V)Communication
8. The student values a society in which individuals participate in making decisions which will affect them.	P I U H	V	1			(V)Freedom (V)Participation (V)Human rights (V)Consensus

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry
1.2.2 Personal conditions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.2.1 Valuing personal development: intellectual, moral, social						
1. The student values curiosity: about reality, self, the future, causes and effects, alternatives, etc.	P I U H	V	1 8 9	5		(V)Curiosity
2. The student values openness to information.	P I U H	V	1 7 8 9	5		(V)Rationality (V)Curiosity (V)Inquiry (V)Intellect (V)Knowledge
3. The student values the ability to recognize problems.	P I U H	V	1 5 7 8 9	4 5		(V)Problem solving (V)Discrimination (V)Rationality (V)Intellect
4. The student values problem solving.	P I U H	V	1 5 7 8 9	4 5	2.1	(V)Problem solving
5. The student values the ability to recognize complexity in situations and relationships (e.g., situation dependency, multi-dimensionality).	P I U H	V	1 5 7 8 9	2 4 5		(V)Complexity (V)Problem solving (V)Discrimination (V)Rationality (V)Intellect
6. The student values intellectual flexibility in dealing with complexity (i.e., ability to change, expand, or construct new frames of reference to match situations).	P I U H	V	1 5 7 8 9	2 4 5		(V)Intellectual flexibility (V)Creativity (V)Resourcefulness (V)Adaptability

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry
1.2.2 Personal conditions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.2.1 Valuing personal development: intellectual, moral, social (Cont.)						
7. The student values complexity (e.g., moving from acceptance of, to pleasure in ambiguity, randomness, or mystery).	P I U H	V	1 7 8 9	4 5		(V)Complexity (V)The unknown (V)Diversity
8. The student values lives of living organisms.	P I U H	V	1	1	3.2	(V)Life
9. The student values the uniqueness or worth of individual lives.	P I U H	V	1 9	1		(V)Life (V)Individuality (V)Respect for others
10. The student values human life.	P I U H	V	1	1		(V)Human life
11. The student values human feelings.	P I U H	V	1	1 5		(V)Human feelings (V)Interpersonal relationships (V)Respect for others (V)Empathy
12. The student values empathy and behavior which demonstrates it.	I U H	V	1			(V)Thoughtfulness (V)Empathy
13. The student values interpersonal relationships.	P I U H	V	1			(V)Interpersonal relations
14. The student values love.	P I U H	V	1			(V)Love
15. The student values open and accurate communications.	P I U H	V	1		2.1.2 2.1.7 2.2.3 7.1.2	(V)Accuracy (V)Communication

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry
1.2.2 Personal conditions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.2.1 Valuing personal development: intellectual, moral, social (Cont.)						
16. The student values knowledge and skills which enable him or her to communicate or interact with other living beings.	P I U H	V	1	4 5		(V)Communication
17. The student values the needs of others.	P I U H	V	1	1 5		(V)Respect for others (V)Sensitivity (V)Understanding
18. The student values autonomy (the ability to process information and make decisions for oneself rather than by others).	P I U H	V	1	4 5		(V)Autonomy (V)Responsibleness
19. The student values his or her ability to recognize a variety of alternatives when solving problems or making decisions.	P I U H	V	1 5 8	4 5		(V)Problem solving (V)Ingenuity (V)Creativity
20. The student values the ability to accurately predict consequences of alternative decisions and actions (probable effects on self, others, and environment).	P I U H	V	1 5	4 5		(V)Predicting (V)Accuracy (V)Responsibleness (V)Problem solving
21. The student values accepting responsibility for the consequences of his/her decisions and actions.	P I U H	V	1			(V)Responsibleness (V)Autonomy (V)Respect for others
22. The student values privacy.	P I U H	V	1			(V)Privacy
23. The student values self-knowledge.	P I U H	V	1			(V)Self-knowledge

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry
1.2.2 Personal conditions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.2.1 Valuing personal development: intellectual, moral, social (Cont.)						
24. The student values self.	P I U H	V	1 9			(V)Self
25. The student values continual expansion of his or her own world view; the ability to relate one's own life to an ever-growing frame of reference as one's knowledge of reality increases.	I U H	V	1			(V)Self-knowledge (V)Intellect (V)Accuracy
26. The student values creativity and imagination; the pleasure of manipulating and extending ideas.	P I U H	V	1 7 8 9			(V)Creativity (V)Imaginativeness
27. The student values the pleasure of learning.	P I U H	V	1 7 8 9			(V)Self-fulfillment (V)Inquiry (V)Intellect (V)Education (V)Pleasure
28. The student values aesthetic experiences.	P I U H	V	1 7 8			(V)Aesthetic sensitivity (V)Beauty
29. The student values novelty; new perceptions, experiences, ideas.	P I U H	V	1 7 8 9			(V)Curiosity (V)Innovativeness
30. The student values a philosophical, unhostile sense of humor.	P I U H	V	1 7			(V)Humor (V)Quality of life

SCIENCE

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry
1.2.2 Personal conditions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classification (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.2.1 Valuing personal development: intellectual, moral, social (Cont.)						
31. The student values mystic experience; the "oceanic" feeling of awe, of feeling simultaneously powerful and helpless, of transcending one's own identity.	P I U H	V	1 7 8 9			(V)The unknown (V)Sensitivity (V)Intellect

1. Values and science
1.2 Valuing the conditions that promote scientific inquiry
1.2.2 Personal conditions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.2.2.2 Valuing information						
1. The student values the continual expansion of human knowledge about reality.	I U H	V	1 7			(V)Insight (V)Knowledge (V)Inquiry (V)Understanding
2. The student values knowledge which represents reality adequately and accurately.	P I U H	V	1 7		2.1.2.2 2.1.2.4 2.1.5.1	(V)Accuracy (V)Rationality
3. The student values information which contributes to human knowledge.	I U H	V	1 7			(V)Insight (V)Knowledge (V)Understanding
4. The student values information received from one's mistakes or from decisions and actions which have yielded unexpected results.	P I U H	V	1 7 8 9		2.1.6.2	(V)Self-knowledge (V)Insight
5. The student values information which human beings are not presently equipped to receive or process; the mysteries, the unknowns which seem to defy human powers of understanding.	P I U H	V	1 7			(V)The unknown
6. The student values information which presents challenges to assumptions, principles, or values currently considered valid (information which forces us to expand and alter current knowledge toward more accurate and adequate representations of reality).	P I U H	V	1 7	4 5	3.2.2.4 5.18	(V)Knowledge (V)Accuracy (V)The unknown (V)Rationality (V)Problem solving

1. Values and science

1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.1 Acquiring information (see also 2.1.1 Acquiring information)						
1. The student values full use of all channels of human perception.	P I U H	V	1 7	4 5	2.1.1.1	(C)Perception (V)Accuracy (V)Inquiry (V)Self-fulfillment
2. The student values full and appropriate use of sense extenders (devices which make more information available or permit reception of different kinds of information than those normally received).	P I U H	V	1 7		2.2.2.1	(C)Tools (C)Perception (V)Inquiry (V)Knowledge (V)Insight
3. The student values freedom from bias: perception of reality which is not limited or distorted by premature judgments or assumptions.	P I U H	V	1 7		2.1.1.1 2.1.2	(C)Perception (V)Accuracy (V)Rationality
4. The student values the human ability to translate information received into representations which can be stored, related, and recalled by the individual.	P I U H	V	1 7	4 5	2.1.3	(V)Intellect (V)Self-respect
5. The student values symbolic representations (e.g., words, mathematical symbols).	P I U H	V	1 7		2.1.3 2.2.3 2.2.5	(C)Data representation (V)Knowledge (V)Communication
6. The student values iconic representations (e.g., images, perceptual models, graphs, diagrams).	P I U H	V	1 7		2.2.4	(C)Data representation (V)Knowledge (V)Communication

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.1 Acquiring information (Cont.)						
7. The student values enactive representations (e.g., dynamic models which permit us to coordinate body movements according to a plan such as learning to ride a bike).	P I U H	V	1 7	4 5	2.1.3 2.2.4	(C)Data representation (V)Knowledge (V)Communication (V)Efficiency
8. The student values representations which are congruent with (match) the reality they purport to represent (which are adequate, accurate and relevant to the situation as it is).	P I U H	V	1 7	4	2.1.2 2.1.5.1	(C)Data representation (V)Accuracy (V)Knowledge (V)Understanding

1. Values and science

1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.2 Validating information (see also 2.1.2 Insuring validity and accuracy of information, and 2.1.5.1 Scientific method)						
1. The student values checking one's representations against the reality they purport to represent (finding out whether the representation is accurate, and evaluating its adequacy and relevance to the situation).	P I U H	V	1 7	4 5		(C)Data representation (V)Accuracy (V)Rationality (V)Objectivity
2. The student values checking the representations communicated by others against the reality they purport to represent (e.g., evaluating authoritativeness of sources, sharing information).	P I U H	V	1 7	4 5		(C)Data representation (V)Accuracy (V)Rationality (V)Communication (V)Objectivity
3. The student values scientific methods used to check representations against reality (e.g., logical operations, experimentation, observation, communication with others).	P I U H	V	1 3 7			(C)Research (V)Accuracy (V)Inquiry (V)Rationality (V)Objectivity
4. The student values the principle that representations may be confirmed if they have predictive validity.	I U H	V	1 3 7			(V)Predicting (V)Inquiry (V)Accuracy (V)Objectivity (V)Consistency
5. The student values distinguishing between reality and its representations (e.g., the object vs. the name of the object; the event vs. the description of it).	P I U H	V	1 7	4 5		(V)Discrimination (V)Judgment (V)Rationality (V)Accuracy

1. Values and science

1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.2 Validating information (Cont.)						
6. The student values distinguishing between kinds of statements (a description, a definition, an explanation, an opinion, a value judgment).	P I U H	V	1 7	4 5	1.1.3.1	(C)Data interpretation (V)Discrimination (V)Judgment (V)Rationality (V)Accuracy
7. The student values the ability to distinguish between relevant and irrelevant data when validating a representation of fact, opinion, or conclusion.	P I U H	V	1 5	4 5	2.1.4.5	(C)Data interpretation (V)Discrimination (V)Accuracy (V)Rationality (V)Judgment

SCIENCE

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.3 Organizing information (see also 2.1.3 Organizing information)						
1. The student values organizations of representations (conceptual schemes, models, classification systems, etc.) which permit recall and retrieval of information.	P I U H	V	1			(V)Organization (V)Knowledge
2. The student values representations organized to permit associations which help one relate to things, ideas, or processes.	P I U H	V	1 7			(V)Organization (V)Clarity
3. The student values representations organized to facilitate communication.	P I U H	V	1			(V)Organization (V)Communication (V)Clarity
4. The student values organizations of representations which minimize distortions (e.g., round world not seen as flat, systems not seen as sequences).	P I U H	V	1 7			(V)Organization (V)Objectivity (V)Perception (V)Accuracy (V)Clarity
5. The student values continual re-evaluation of organizational schemes and the restructuring or creating of schemes to accommodate increasing information (e.g., basic elements may no longer be considered air, fire, water, and earth; life forms may no longer be classified into two kingdoms only).	I U H	V	1 8 9			(V)Organization (V)Adaptability (V)Intellectual flexibility (V)Creativity (V)Accuracy (V)Clarity

1. Values and science

1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.4 Processing information: interpreting (see also 2.1.4 Interpreting information)						
1. The student values the ability to accurately decode information from representations made by others.	P I U H	V	1 7			(C)Data interpretation (V)Accuracy (V)Communication
2. The student values logical inferences and the ability to infer from data.	P I U H	V	1 7			(C)Data interpretation (V)Rationality (V)Ingenuity
3. The student values analysis; the examining of a whole part by part.	U H	V	1 7			(C)Data interpretation (V)Inquiry (V)Resourcefulness
4. The student values synthesis; the construction of a whole from its component parts.	U H	V	1 7			(C)Data interpretation (V)Inquiry (V)Resourcefulness
5. The student values the complementary nature of analysis and synthesis.	U H	V	1 7			(C)Data interpretation (V)Insight (V)Inquiry
6. The student values abstraction and generalization.	U H	V	1 7 8			(C)Data interpretation (V)Insight (V)Inquiry

SCIENCE

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.4 Processing information: interpreting (Cont.)						
7. The student values representations which permit us to refine and specify factors being related, or relationships being interpreted (e.g., measurements, equations, graphs, displays).	U H	V	1 7 8	4	2.2.1 2.2.4 2.2.5	(C)Data interpretation (V)Clarity (V)Organization (V)Utility

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.5 Producing new information (see also 2.1.5 Using information to produce new information						
1. The student values extensions of representations which permit us to discover new relationships and possibilities.	I U H	V	1 7 8			(C)Data interpretation (V)Innovativeness (V)Imagination (V)Creativity (V)Insight (V)Self-fulfillment (V)Inquiry
2. The student values experimentation and observation as sources of new information (if predictions are not validated, or results of inquiry are inconclusive or unexpected, these results carry information which suggests new possibilities).	P I U H	V	1 7 8			(V)Knowledge (V)Insight (V)Inspiration (V)Inquiry (V)Problem solving
3. The student values the use of problem-solving and inquiry strategies which increase one's knowledge of factors and relationships involved in a situation.	P I U H	V	1 7 8	4 5		(V)Understanding (V)Problem solving (V)Inquiry (V)Knowledge (V)Insight
4. The student values situation dependency and multi-dimensionality.	U H	V	1 7 8			(V)Complexity (V)Knowledge (V)Rationality
5. The student values full use of appropriate technological devices for extending and relating representations to yield new information (e.g., precision instruments, calculators, computers).	I U H	V	1 7 8	4 5		(C)Data interpretation (C)Tools (C)Technology (V)Knowledge (V)Insight (V)Inquiry (V)Resourcefulness (V)Utility

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.6 Acting on the basis of information (see also 2.1.6 Acting on the basis of information - decision making)						
1. The student values the restructuring and reordering of one's values as one's knowledge and skills increase.	I U H	V	1	4 5	1.1.7	(V)Growth and development (V)Self-direction (V)Self-discipline
2. The student values increasing knowledge of the ways in which values, knowledge, and skills interact in decision-making and problem-solving.	I U H	V	1	4 5	1.1.4	(V)Self-knowledge (V)Insight
3. The student values the ability to apply values to situations appropriately (to evaluate situations in their own contexts, rather than in terms of one's own, perhaps irrelevant, values).	I U H	V	1	4 5		(V)Discrimination (V)Rationality (V)Judgment
4. The student values the ability to analyze, clarify, and prioritize values.	I U H	V	1	4 5	1.1	(C)Behavior (V)Self-knowledge (V)Problem solving (V)Growth and development (V)Self-direction (V)Self-discipline
5. The student values the restructuring of behavior in response to more adequate and accurate information about situations.	I U H	V	1	4 5		(C)Behavior (V)Growth and development (V)Self-direction (V)Self-discipline

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.6 Acting on the basis of information (Cont.)						
6. The student values consistency between one's values and one's behavior.	P I U H	V	1	4 5		(C)Behavior (V)Consistency (V)Self-direction (V)Self-discipline (V)Self-respect
7. The student values responsible decision-making (decisions are based on adequate, accurate, and relevant information, represented with predictive validity--decisions will yield expected results).	P I U H	V	1	4 5		(V)Decision making (V)Responsibleness (V)Judgment (V)Rationality (V)Self-respect
8. The student values the ability to learn from mistakes; to respond constructively to feedback.	P I U H	V	1	4 5		(V)Growth and development (V)Resourcefulness (V)Self-confidence
9. The student values accuracy in encoding information (representing for communication).	P I U H	V	1	4 5	2.1.7	(C)Communication (V)Communication (V)Accuracy
10. The student values appropriate choices of representations for use in communicating information.	P I U H	V	1		2.1.7	(C)Communication (V)Communication (V)Clarity (V)Organization
11. The student values creative activities which express or represent one's knowledge, skills, values, and feelings.	P I U H	V	1 7 8 9	4 5		(C)Communication (V)Communication (V)Self-expression (V)Creativity (V)Pleasure

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.7 Communicating information (see also 2.1.7 Communicating information)						
1. The student values communication needed to stimulate, clarify, extend and evaluate one's own representations of reality.	P I U H	V	1 7	4 5		(C)Communication (V)Communication (V)Self-knowledge (V)Inspiration (V)Clarity (V)Accuracy (V)Rationality
2. The student values accuracy and openness of communication.	P I U H	V	1			(C)Communication (V)Communication (V)Accuracy (V)Openness
3. The student values knowledge and skills which permit one to communicate information meaningfully.	P I U H	V	1 7			(C)Communication (V)Communication (V)Knowledge (V)Mastery (V)Clarity
4. The student values the systems and devices by which scientific information is communicated.	P I U H	V	1 7		2.2.3 2.2.4 2.2.5	(C)Data representation (V)Communication (V)Communication (V)Utility (V)Productivity
5. The student values the full and appropriate use of scientific literature and information retrieval systems.	I U H	V	1 7		7.	(C)Communication (V)Communication (V)Utility (V)Inquiry (V)Knowledge

1. Values and science
1.3 Valuing the processes of scientific inquiry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.3.7 Communicating information (Cont.)						
6. The student values information storage and retrieval systems which give us access to scientific knowledge accumulated in the past, or in other places: systems which permit us to build on previous knowledge.	I U H	V	1 7 8		2.1.1.2 7.3.1	(C)Communication (V)Utility (V)Communication (V)Inquiry (V)Knowledge (V)Progress

1. Values and science
1.4 Valuing the uses of science in meeting human needs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.4.1 Personal needs						
1. The student values the role of science in meeting physiological needs (e.g., assuring food supply, developing systems for preserving foods, developing new materials and techniques for construction, identifying and developing sources of energy for production, transportation, and comfort).	P I U H	V	1 7	1 2		(C)Technology (V)Quality of life (V)Interdependence (V)Security (V)Survival
2. The student values the uses of science in meeting security needs (e.g., alleviating sickness and preventing epidemics; assuring safety of buildings, bridges, etc. through stress/strain analysis; relieving anxiety and treating mental illness; identifying limits of natural resources and identifying alternatives to avoid catastrophe or sudden depletion).	P I U H	V	1 7	1 2		(V)Quality of life (V)Interdependence (V)Security
3. The student values scientific knowledge and skills which enable us to meet our own physiological and security needs (e.g., growing food, learning to drive, repairing machinery, moving loads, making reliable predictions).	P I U H	V	1 7	1 2		(V)Survival (V)Quality of life (V)Security (V)Resourcefulness (V)Self-confidence (V)Utility (V)Autonomy

1. Values and science
1.4 Valuing the uses of science in meeting human needs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.4.1 Personal needs (Cont.)						
4. The student values the role of science in meeting needs for belonging and love (e.g., through communication and information theory to build and maintain personal communications systems such as telephone, postal service and (soon) user-oriented cable TV with user feedback).	P I U H	V	1 7	1 2		(C)Communication (V)Quality of life (V)Interpersonal relations (V)Communication (V)Fellowship (V)Participation (V)Community
5. The student values the role of science in meeting needs for esteem of others (e.g., formal recognition of scientific merit, recognition by others of one's personal problem-solving skills or the mastery of difficult information).	I U H	V	1 7 9	1 2		(V)Quality of life (V)Self-confidence
6. The student values the role of science in meeting needs for self-esteem (e.g., satisfactions gained in having successfully applied scientific principles or mastered difficult information; knowledge, skills, and experiences which provide insight about oneself).	I U H	V	1 7 9	1 2		(V)Self-respect (V)Quality of life
7. The student values the role of science in self-actualization (e.g., providing intellectual challenges, providing groups and organizations through which knowledge may be pursued, providing opportunities to contribute to the general well-being of humankind).	U H	V	1 7 8 9	1 2		(V)Self-fulfillment (V)Quality of life

1. Values
1.4 Valuing the uses of science in meeting human needs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.4.2 Societal needs						
1. The student values the role of science in meeting society's needs for communication (e.g., mass communication systems; systems for storage and retrieval of information; standardization of terms, symbols, measurement units, etc.).	P I U H	V	1		2.1.7.3	(C)Communication (V)Communication (V)Community (V)Utility (V)Quality of life
2. The student values the role of science in meeting society's needs for information processing (e.g., data processing systems; models and procedures for making decisions and planning policy in complex situations).	I U H	V	1		2.2.2.3 2.2.4	(C)Information (C)Data processing (V)Utility (V)Problem solving (V)Community (V)Quality of life
3. The student values the role of science in meeting society's health, welfare and survival needs (e.g., knowledge of earth's systems needed for allocation and use of natural resources, medical knowledge and procedures, agricultural knowledge, problem solving procedures and technology).	P I U H	V	1 7	1	2.1.5 3.5	(V)Quality of life (V)Utility (V)Security (V)Community (V)Survival

1. Values and science
1.4 Valuing the uses of science in meeting human needs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1.4.2 Societal needs (Cont.)						
4. The student values the role of science in meeting needs for distributing resources, goods, and services.	P I U H	V	1	1		(V)Community (V)Utility (V)Productivity (V)Quality of life (V)Security
5. The student values the role of science in meeting national or cultural needs of esteem (e.g., Nobel prizes, space research, architectural feats, prestigious institutes).	P I U H	V	1			(V)Community (V)Quality of life

2. Processes and science

2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1 Acquiring information						
1. The student knows the location and use of print and nonprint materials related to acquiring information (e.g., card catalog: "Perception," "Senses and Sensation," "Research"; Dewey Decimal Classification and Relative Index; SUBJECT GUIDE TO BOOKS IN PRINT: "Information Storage and Retrieval Systems," "Library Catalogs," "Electronic Data Processing-Library Science"; ERIC; OTIS; READER'S GUIDE: "Information Storage and Retrieval Systems"; Microforms; LEARNING DIRECTORY: "Observation Skill," "Retrieval System Theory," "Computer Information Retrieval," "Filing, Indexing," "Taxonomy"; Telelecture).	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing						
1. The student is able to acquire information from reality through his or her own powers of observation (e.g., perceiving, experiencing; receiving information from external environment; and information about oneself).	P I U H	P11 P12 P13 P14 P15 P17	1 2 7 9			(C) Information (C) Perception (V) Growth and development
2. The student knows that concepts of reality are based on an individual's perceptions.	P I U H	G2 K8	1 4			(C) Perception (V) Self-concept
3. The student knows contributions of traditional and new disciplines to our growing knowledge of the nature and functions of human perception (e.g., behavioral, biological, information and communications sciences, philosophy, mathematics, theology, arts).	U H	K2 K8	1 4		3.2.4.3 5.17	(C) Perception (C) Research
4. The student knows conventional models used in studies of human perception (e.g., "five senses" model--sight, sound, touch, taste, smell categories; communication system model--receivers, channels; processing, storage, retrieval, and transmissions of information).	P I U H	K2	1 3 4			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing						
5. The student is able to use appropriate scientific terms and models for human senses or information channels.	P I U H	P65	1 2 3 7	5		(V)Accuracy (V)Perception (V)Growth and development
6. The student is able to increase the amount or rate of information he or she receives through various channels (e.g., speed reading techniques--scanning, etc.--cybernetic devices).	U H	P65	1 2 3 7	5		(V)Perception (V)Accuracy (V)Efficiency
7. The student is able to concentrate his or her attention on information being received through one appropriate channel (e.g., screen out sounds when reading, screen out visual distractions when listening).	P I U H	P65	2 3 7	5		(V)Perception (V)Efficiency (V)Self
8. The student is able to lengthen his or her attention span.	P I U H	P65	2 3 7	5		(V)Perception (V)Efficiency
9. The student is able to distinguish figure from ground when receiving information visually (e.g., see a particular object among many objects in field of vision; see a particular line of words out of all words on page).	P I U H	P11 P45 P65	2 3 7	5		(V)Self (V)Perception (V)Accuracy (V)Efficiency (V)Discrimination

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
10. The student is able to perceive spatial relationships visually (i.e., positions of objects in relation to each other, distances, sizes).	P I	P11	2			(V)Perception (V)Accuracy
11. The student is able to use accurate terms for relative positions (e.g., under, over, inside, outside, behind, in front of, here, there, away).	P I	P31 P65	2 3			(V)Perception (V)Accuracy
12. The student is able to use accurate terms for distances (e.g., long, short, near, far, inch, foot, mile).	P I	P31 P65	2 3			(V)Perception (V)Accuracy
13. The student is able to perceive size relationships visually.	P I	P11	2			(V)Perception (V)Accuracy
14. The student is able to use accurate terms for size relationships (e.g., larger, smaller, greater, lesser).	P I	P31 P65	2 3			(V)Perception (V)Accuracy
15. The student is able to perceive sizes in relationship to distance (e.g., recognize that things appear smaller the farther they are from one's eyes).	P I	P11	2			(V)Perception (V)Accuracy

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
16. The student is able to perceive constancy of forms or symbols visually (e.g., recognize a circle, whether it appears large or small in field of vision; recognize known symbol in various positions and sizes).	P I	P11	2			(V)Perception (V)Accuracy
17. The student is able to use accurate terms for shapes and symbols (e.g., names of geometric shapes, names of letters, numerals).	P I	P31 P65	2 3			
18. The student is able to perceive color differences.	P I	P11 P45	2			
19. The student is able to use accurate descriptive and identifying terms for colors (e.g., light, dark, bright, dim; color names).	P I	P11 P31 P65	2 3			
20. The student is able to distinguish message from noise when receiving auditory information (e.g., hear one voice out of many voices, distinguish between relevant and extraneous sounds).	P I	P12	2			
21. The student is able to perceive direction and distance of sound signals.	P I	P12	2			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
22. The student is able to perceive relative temperatures through touch.	P I	P13	2			
23. The student is able to use accurate descriptive terms for temperatures (e.g., hot, warm, cool, cold).	P I	P31 P65	2 3			
24. The student is able to perceive textures, shapes and sizes of objects through touch.	P I	P13	2			
25. The student is able to use accurate terms for textures, shapes, and sizes (e.g., rough, smooth; wet, dry; round, flat; large, small).	P I	P31 P65	2 3			
26. The student is able to receive information about properties of objects through perceptions of odors and/or taste.	P I	P14 P15	2			
27. The student is able to use accurate terms for tastes and odors (e.g., sour, sweet, salty, bitter).	P I	P14 P15 P31 P65	2 3			
28. The student is able to perceive time relationships and sequences.	P I	P34	2			
29. The student knows that time perception is a function of memory.	P I	K7	4			
30. The student is able to use accurate terms for time relationships (then, now, before, after), time units (hour, week, month, year), or relative positions in time (yesterday, today, tomorrow, next week).	P I	P31 P65	2 3		2.2.1.5	

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
31. The student is able to perceive motion and changes in motion.	P I	P34	2			
32. The student is able to use accurate terms for rates, directions, and kinds of motion (e.g., fast, slow; forward, backward, around; turn, twist, bend, slide, run, walk).	P I	P31 P65	2 3			
33. The student is able to receive information about situations using two or more perception channels at once (e.g., using vision and touch to perceive texture of objects, using vision and hearing to perceive events).	P I	P65	2			(V)Perception (V)Efficiency
34. The student is able to acquire accurate information about his or her own state.	P I U H	P17	2			(V)Perception (V)Accuracy (V)Self-knowledge
35. The student knows that internal sensors throughout the human body receive and transmit information to the brain.	P I U H	K7	4		5.17	(C)Information
36. The student knows current research and theories about the nature, functions, and conscious use of internal information channels (internal sensors, nervous system, endocrine system, etc.)	I U H	G1 K7	4		3.2.2 3.2.4	

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
37. The student knows that some internal information is processed without the individual's conscious awareness or direct control (e.g., information which permits regulation of heartbeat, breathing, perspiring).	P I U H	K7	4			(C)Regulation
38. The student knows that some internal information is consciously processed (e.g., pain, hunger, thirst, emotional response).	P I U H	K7	4			
39. The student knows that emotions are responses which may themselves contain information: they tell us about our state at a given time and can indicate our needs, accomplishments, progress, etc.	P I U H	K3	4			
40. The student knows emotions which indicate personal need for more information (e.g., ambition, anticipation, curiosity, confusion, conflict, anxiety, frustration).	P I U H	K5	4	4 5		(V)Self-knowledge (V)Discrimination
41. The student knows emotions which indicate personal progress toward or achievement of a goal (e.g., anticipation, satisfaction, pleasure, confidence, excitement).	P I U H	K5	4	4 5		(V)Self-knowledge (V)Discrimination
42. The student is able to use accurate terms for internal perceptions and feelings (emotions).	P I U H	P31 P65	2			(V)Accuracy (V)Perception

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
43. The student knows that internal and external perceptions provide information needed to coordinate and direct muscle activity (e.g., follow a line of words, maintain balance, focus a microscope).	P I U H	K7	4			
44. The student is able to increase his or her visual-motor or coordination skills.	P I U H	P65	2		7.1	(V)Growth and development (V)Efficiency
45. The student is able to alter or extend his or her perception through changes in perspective or frame of reference, or use of sense-extending equipment.	P I U H	P16 P65	2			
46. The student is able to select and use sense extenders appropriate to the information desired and the subject being observed (e.g., microscope for viewing small objects, stethoscope for hearing muffled sounds, electronic equipment for magnifying or translating inaudible sounds).	P I U H	P16 P33 P65	2 3		2.2.2.1	

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.1 Perceiving, experiencing (Cont.)						
47. The student knows that people acquire information from each other through personal interaction (perceiving and decoding words, gestures, and expressions of others) and through media (perceiving and decoding symbols, illustrations, and other representations).	P I U H	K5 K7	4	5		(C)Communication
48. The student is able to increase the amount or accuracy of information he or she acquires from interactions with other people (e.g., interpersonal communication skills).	P I U H	P65	2 3	5	2.1.7.2	(C)Communication (V)Accuracy (V)Efficiency (V)Growth and development
49. The student is able to increase the amount or accuracy of information he or she acquires from media (e.g., reading, reference, study skills).	P I U H	P65	2 3	5	7	(V)Accuracy (V)Efficiency (V)Growth and development

2. Processes
2.1 Universal problem solving-inquiry processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.2 Locating and using resources (see also 7.3.1 Location of resources)						
1. The student is able to use a variety of sources to acquire information (e.g., personal observations, stored information).	P I U H	P65	2	5		(V)Openness (V)Resourcefulness (V)Utility (V)Inquiry
2. The student knows general categories of information sources available in his or her locality (e.g., museums, book collections, audio-visual collections, agencies, institutions, private organizations).	P I U H	K5 K6	4	5	8.5	(V)Resourcefulness (V)Discrimination (V)Inquiry
3. The student is able to identify local sources of information relative to purpose of inquiry (e.g., field trips or field observation sites, libraries, museums, resource people).	P I U H	P23 P33	2	5	8.5	(V)Resourcefulness (V)Discrimination (V)Inquiry
4. The student is able to identify sources of relevant information available through correspondence, telecommunications, etc. (e.g., state libraries, ERIC, Government Printing Office, universities, corporations).	I U H	P23 P33	2	5	8.5	(V)Resourcefulness (V)Discrimination (V)Inquiry
5. The student is able to retrieve alphabetically-stored information (e.g., find desired entry in phone book, card catalog, index; find book on library shelf, etc.).	P I U H	P34 P41 P65	2	5		(V)Resourcefulness (V)Organization (V)Inquiry

2. Processes
2.1 Universal problem solving-inquiry processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.2 Locating and using resources (Cont.)						
6. The student is able to retrieve numerically-stored information (e.g., find page from listing in index or table of contents; find nonsystem book on library shelf; find entry in a chronological file).	P I U H	P34 P41 P65	2	5		(V)Resourcefulness (V)Organization (V)Inquiry
7. The student is able to use technological systems for retrieving information (e.g., key-punch, computer).	I U H	P35 P65	2 3	5		(V)Resourcefulness (V)Inquiry (V)Utility
8. The student is able to follow printed directions to locate stored information (e.g., posted instructions, application forms).	I U H	P41 P65 P72	2	5		(V)Resourcefulness (V)Efficiency (V)Inquiry
9. The student is able to follow maps, illustrations, and other graphic guides to locate information sources.	I U H	P41 P65 P72	2	5		(V)Resourcefulness (V)Efficiency (V)Inquiry
10. The student is able to follow verbal directions to locate information sources.	I U H	P41 P65 P72	2	5		(V)Resourcefulness (V)Efficiency (V)Communication (V)Inquiry
11. The student is able to employ conventional research techniques when locating information sources (e.g., searching for related topic headings in indexes, catalogs, directories, using footnotes and bibliography as leads to related information, questioning resource people).	I U H	P41 P44 P65	2	5		(V)Resourcefulness (V)Efficiency (V)Inquiry

2. Processes
2.1 Universal problem solving-inquiry processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.2 Locating and using resources (Cont.)						
12. The student is able to employ an efficient strategy when locating a particular entry out of a set of entries in a reference system (e.g., "20 questions" strategy, based on principles of information theory).	I U H	P65	1 2 3	5	5.17	(V)Resourcefulness (V)Efficiency (V)Inquiry
13. The student knows that a particular entry out of a set may be found with the maximum efficiency when one narrows his search by half with each entry examined; (i.e., pick middle entry of whole set to see whether desired entry would be before or after it, thus identifying the half to look in next; then pick middle entry of that half to identify proper fourth, etc., until desired entry is found).	I U H	K2	1 3 4	5	5.17	(V)Efficiency (V)Inquiry
14. The student is able to use appropriate procedures for gaining access to stored information (e.g., placing orders, borrowing books, or audio-visuals, operating projectors, purchasing materials).	P I U H	P65	2	5		(V)Resourcefulness (V)Efficiency (V)Inquiry
15. The student is able to select resource people who are able to give relevant information and/or suggest other relevant sources.	I U H	P33	2	5	8.5	(V)Resourcefulness (V)Discrimination (V)Inquiry

2. Processes
2.1 Universal problem solving-inquiry processes
2.1.1 Acquiring information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.1.2 Locating and using resources (Cont.)						
16. The student is able to use appropriate procedures for contacting resource people (e.g., corresponding, making appointments, telephoning).	I U H	P65	2	5		(V)Resourcefulness (V)Discrimination (V)Efficiency (V)Inquiry
17. The student is able to use appropriate questioning strategies to acquire information from an individual (e.g., ask relevant, logical questions, formulate questions according to the kind of response desired--factual recall, convergent, divergent, etc.).	I U H	P33 P74	2	5		(V)Resourcefulness (V)Discrimination (V)Efficiency (V)Inquiry
18. The student is able to use communication skills and conventions of courtesy when questioning individuals.	I U H	P65 P74	2	1 5	2.1.7.2.2	(C)Communication (V)Resourcefulness (V)Respect for others (V)Inquiry

2. Processes and science

2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2 Insuring validity and accuracy of information						
1. The student knows the location and use of print and nonprint materials related to insuring validity and accuracy of information (e.g., SUBJECT GUIDE TO BOOKS IN PRINT: "Educational Research," "Testing," "Bibliography"; LEARNING DIRECTORY: "Evaluation," "Evaluation, Educational," "Source, Primary and Secondary," "Source, Information").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that "raw" information is translated into symbols, images, or enactive models in human minds.	I U H	G1 K7	1 4		1.3.1 5.17	(C)Information (V)Perception (V)Intellect
3. The student knows that humans represent information to store or share through symbols, images, and models in various media (e.g., writing, print, art forms, film, electronic coding).	I U H	G1 K7	1 4			(C)Communication (C)Data representation (V)Knowledge
4. The student knows that a central concern of science is the systematic, thorough checking of represented information (i.e., what we think we know).	I U H	G1 K2	1 4			(C)History of science (V)Knowledge (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2 Insuring validity and accuracy of information (Cont.)						
5. The student knows that validating information means checking representations against the reality they are purported to represent.	I U H	K2	1 4			(V)Inquiry (V)Knowledge
6. The student knows that representations match (are congruent with) reality if they are accurate, adequate, and relevant to the real situation involved.	I U H	K9	1 4			(V)Inquiry (V)Accuracy (V)Knowledge
7. The student knows that scientific inquiry is one "way of knowing" truth, or reality, within the limitations of human capabilities.	I U H	G2 K7	1 4	5	2.1.1	(V)Inquiry (V)Knowledge
8. The student knows that the processes of scientific inquiry are used to check the accuracy, adequacy, and relevance of represented information.	P I U H	G1 K7	1 4			(V)Inquiry (V)Utility (V)Knowledge
9. The student knows ways in which scientific inquiry differs from other ways of knowing (e.g., validating by test against reality, rather than by feelings, values, ideologies, intuition; precise documentation of observations, perceptions through standardized measurements and terminology).	I U H	K5	1 4			(V)Inquiry (V)Knowledge

2. Processes and science
2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2 Insuring validity and accuracy of information (Cont.)						
10. The student knows that the principle of predictive validity is basic to scientific inquiry (i.e., predicted outcomes of a test or observation will only occur if the representation being tested is adequate, accurate, and relevant to the real situation).	U H	G1 K8 K9	1 4	5		(V)Inquiry (V)Knowledge (V)Prediction (V)Rationality

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.1 Evaluating authoritativeness of sources						
1. The student is able to evaluate the authoritativeness of a source of information (e.g., book, film, individual communication).	P I U H	P21	1 2 3 9	5		(V)Inquiry (V)Critical judgment
2. The student knows ways of evaluating the authoritativeness of sources, including: (1) checking dates-how current is the data? (2) checking professional reputation of person or group who communicated the information; (3) checking to see whether information communicated is really within the authority's area of expertise.	P I U H	K2 K7	1 3 4	5		(V)Inquiry (V)Critical judgment
3. The student knows that as human knowledge expands and change occurs, today's authority is sometimes tomorrow's scapegoat (i.e., knowledge considered adequate and accurate at one time may later be proved inaccurate by further research, or inadequate to represent changing conditions, etc.).	U H	G2 K4	1 4			(V)Knowledge (V)Critical judgment (V)Perspective (V)Humor

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.2 Evaluating logical consistency and accuracy						
1. The student is able to evaluate the internal consistency and accuracy of data and conclusions communicated by others, or acquired through personal experience.	P I U H	P22	1 4	5		(V)Rationality (V)Critical judgment (V)Accuracy
2. The student is able to identify logical inconsistencies (e.g., contradictions, incomplete sequences, unfounded inferences).	P I U H	P22	1 4	5		(V)Consistency (V)Rationality
3. The student is able to identify irrelevant or inappropriate applications of principles, measurements, procedures, criteria, etc.	I U H	P22	1 4	5		(V)Accuracy (V)Rationality
4. The student is able to identify conflicting data, interpretations, or definitions.	P I U H	P22	1 4	5		(V)Consistency (V)Rationality (V)Discrimination
5. The student is able to recognize statements of facts (e.g., descriptive data acquired through observation or experimentation).	P I U H	P22	1 3 4	5	1.1.3.1	(V)Objectivity (V)Discrimination
6. The student is able to recognize definitional statements (i.e., words or equations that specify the factors and relationships represented by a term or symbol).	P I U H	P22	1 3 4	5	1.1.3.1	(V)Objectivity (V)Discrimination

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.2 Evaluating logical consistency and accuracy (Cont.)						
7. The student is able to recognize interpretative statements (e.g., hypotheses, generalizations, conclusions, theories, predictions).	P I U H	P22	1 3 4	5	1.1.3.1	(V)Objectivity (V)Discrimination
8. The student is able to recognize statements of opinion or belief.	P I U H	P22	1 3 4	5	1.1.3.1	(V)Objectivity (V)Discrimination
9. The student is able to recognize value judgments.	P I U H	P22	1 3 4	5	1.1.3.1	(V)Objectivity (V)Discrimination
10. The student is able to recognize literary forms in which descriptions, interpretations, definitions, etc. have artistic, rather than scientific functions (e.g., fantasy, humor, hyperbole, metaphor, etc.).	P I U H	P22 P45	1 3 4	5		(V)Objectivity (V)Discrimination (V)Aesthetic judgment
11. The student is able to distinguish between objective models and artistic analogies (e.g., analogies that aid comprehension of scientific knowledge--life as interactions within a system--vs. analogies that express feelings or values--life as a "tale told by an idiot, full of sound and fury, but signifying nothing").	P I U H	P22 P45	1 3 4	5		(V)Objectivity (V)Discrimination (V)Aesthetic judgment

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.2 Evaluating logical consistency and accuracy (Cont.)						
12. The student is able to detect data, conclusions or assertions that may be distorted by personal or organizational bias (e.g., environmental impact studies intended to justify or to oppose construction of new industrial plant).	U H	P22 P45	1 3 4	5		(V)Accuracy
13. The student is able to recognize factual conclusions or assertions which are unsupported by accompanying data or references.	I U H	P22 P45	1 3 4	5		(V)Critical judgment
14. The student is able to evaluate the validity of data used to support a conclusion (e.g., currency of data, procedures used to gather, record, and interpret it, relevance of data to conclusion).	I U H	P22 P45	1 3 4	5	2.1.4	(V)Critical judgment (V)Utility
15. The student is able to detect organizational frameworks which distort or eliminate information (e.g., things in categories which do not have commonalities represented; representations of complex information in oversimplified model; definitions used inconsistently).	U H	P22 P45	1 3 4	5		(V)Accuracy (V)Organization
16. The student is able to test accuracy of representations by personal observation or experimentation.	P I U H	P22 P53	1 3 4 9	5	2.1.5	(C)Research (V)Inquiry (V)Accuracy (V)Self-direction (V)Resourcefulness

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.3 Evaluating relevance to purposes or objectives						
1. The student is able to identify the purpose or objective of an inquiry.	P I U H	P66	2 3			
2. The student is able to distinguish between information which is relevant to an inquiry and that which is not.	P I U H	P23 P45	2			
3. The student knows factors to consider in evaluating the relevance of information, including: subject of inquiry, degree of accuracy needed, level of specificity or generality needed.	P I U H	K9	3 4			
4. The student is able to evaluate the relevance of principles, prior assumptions, or procedures being applied to a new inquiry situation.	I U H	P23	2			
5. The student is able to evaluate the relevance of new information to the purpose and subject of an inquiry.	I U H	P23	2			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.4 Evaluating adequacy for acting or deciding (see also 2.1.6 Acting on the basis of information)						
1. The student knows that valid decisions are based on adequate knowledge of the situation in question, and of oneself (e.g., needs, values, responses; the criteria by which one decides).	I U H	G2 K9	4	5	1.1	(V)Decision making (V)Self-knowledge
2. The student knows that with adequate information, one may make reliable predictions about the consequences of a decision.	P I U H	G2 K7	4	4 5		(V)Decision making (V)Prediction (V)Knowledge
3. The student knows that adequacy of information is determined by the scope of the inquiry, and the accuracy with which factors are represented, not by the amount of data assembled (e.g., lots of accurate rainfall statistics do not fully represent climatic conditions).	I U H	G2 K9	4	5		(V)Inquiry (V)Knowledge (V)Openness
4. The student knows indicators of inadequate information or incomplete research (e.g., empty categories, confusing data, unexpected results of hypothesis test).	I U H	K9	4	5	2.1.1.1	
5. The student is able to determine the adequacy of procedures being used in an inquiry (e.g., Is this strategy efficient? Is it yielding the information I need?).	I U H	P24	2 3	5	2.1.1.2	(V)Inquiry (V)Efficiency (V)Utility

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.4 Evaluating adequacy for acting or deciding (Cont.)						
6. The student is able to evaluate the adequacy (scope, completeness) of experimental data as a basis for reaching conclusions (e.g., size and distribution of sample, time period covered, variables measured, controls used).	U H	P24	2 3	5		(V)Inquiry
7. The student is able to determine the adequacy of information at each stage of inquiry (information gathering, validating, organizing, interpreting, acting upon).	I U H	P24	2 3	5		(V)Inquiry
8. The student is able to evaluate the adequacy of his or her self-knowledge in making a decision (e.g., personal values, priorities, probable responses; unexamined feelings, unrecognized needs).	I U H	P24	2 5	5	1.1	(V)Inquiry (V)Decision making (V)Self-knowledge
9. The student is able to evaluate the adequacy of information that underlies personally held values or principles.	U H	P24	2 5	5	1.1.3 1.1.4	(V)Inquiry (V)Self-knowledge

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.2 Insuring validity and accuracy of information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.2.4 Evaluating adequacy for acting or deciding (Cont.)						
10. The student is able to distinguish between broadly applicable value principles and the norms or conventions which express them in a particular society or group.	U H	P24 P45	2 5	5		(V)Discrimination
11. The student is able to determine the adequacy of a norm or principle to serve as a guide to a decision or action in a particular situation.	U H	P24	2 5	5	1.3.5	(V)Inquiry (V)Decision making (V)Discrimination

2. Processes and science

2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3 Organizing information						
1. The student knows the location and use of print and nonprint materials related to organizing information (e.g., card catalog: "Information Storage and Retrieval Systems," "Management," "Classification"; SUBJECT GUIDE TO BOOKS IN PRINT: "Information Storage and Retrieval Systems," "Classification," "Abstracting and Indexing Services," "Coding Theory"; LEARNING DIRECTORY: "Computation," "Encoding Skill," "Information Processing"; periodicals: *Government Information Systems*, *Journal of Educational Data Processing*).	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.1 Labeling, naming, numbering, coding						
1. The student is able to use accurately conventional systems and terms for labeling or naming objects, materials, categories, etc.	P I U H	P31	2 3		2.1.6.3	
2. The student is able to use accurately common and scientific names.	P I U H	P31	2 3		2.2.3	
3. The student is able to use accurately conventional numbering systems and symbols.	P I U H	P31	2 3			
4. The student is able to code information according to a conventional system (e.g., computer language, key sort).	I U H	P31	2 3			
5. The student is able to devise codes or systems for personal organization, storage, and retrieval of information.	P I U H	P31	2 3 8			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.2 Recording, listing						
1. The student is able to record information in a variety of ways (e.g., written notes, tape recordings, audiovisual media, video tape, etc.).	P I U H	P32	2 3	5		(V)Utility (V)Resourcefulness
2. The student is able to select and use recording systems which are appropriate to the subject, the conditions under which he or she is working, and the intended use of the information.	P I U H	P32	2 3	5		(V)Utility (V)Resourcefulness (V)Discrimination
3. The student is able to use a variety of forms for recording observational or experimental data (e.g., graphs, tables, check lists, notes).	P I U H	P32	2 3			(C)Data representation (V)Inquiry (V)Utility (V)Resourcefulness
4. The student is able to record information accurately.	P I U H	P32	2 3	5		(V)Accuracy
5. The student is able to record information clearly (e.g., legible writing; audible tape recording).	P I U H	P32	2 3	5		(V)Clarity

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.3 Classifying, categorizing, grouping, selecting according to criteria (see also 3.2.3.1 Classification systems)						
1. The student knows that classifying is a way of sorting and organizing information so that things which have common characteristics are found together.	P I	G2 K2 K6	3 4			(V)Organization
2. The student is able to identify similarities and differences in observable characteristics of objects.	P	P45	2 3			(V)Discrimination
3. The student is able to group objects according to observable similarities.	P	P33	2 3			
4. The student is able to categorize representations (words, pictures, symbols, statements, etc.) by similarities in form, meaning, use, or other criteria.	P I	P33	2 3			
5. The student is able to group or categorize objects or representations by a variety of criteria.	P I	P33	2 3			
6. The student knows that classification systems are based on one, two, or multiple stages of comparing and sorting.	I U H	K2	3 4			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.3 Classifying, categorizing, grouping, selecting according to criteria (Cont.)						
7. The student is able to construct categories into which objects or information may be grouped (e.g., identify criteria, name categories).	P I U H	P33	2 3			
8. The student knows the meanings of the terms subcategory, subset, subgroup, etc.	P I U H	K2	3 4			
9. The student is able to classify a set of objects or representations into parallel subcategories (e.g., category: children in class; sub-categories: girls, boys).	P I U H	P33	2 3			
10. The student is able to distinguish between parallel and nonparallel categories in a classification system (e.g., walkers/riders vs. walkers/singers).	P I U H	P33 P45	2 3			(V)Discrimination
11. The student is able to distinguish between exclusive and overlapping categories (e.g., plant/animals vs. plants/marine organisms).	P I U H	P33 P45	2 3			(V)Discrimination

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.3 Classifying, categorizing, grouping, selecting according to criteria (Cont.)						
12. The student is able to distinguish between the various levels of specificity in a classification system (e.g., world, continent, country, state, county, city, neighborhood).	P I U H	P33 P45	2 3			(V)Discrimination
13. The student is able to construct a classification scheme.	I U H	P33	2 3			
14. The student is able to categorize information according to conventional classification schemes (e.g., outline, taxonomy, table, time line).	I U H	P33	2 3			
15. The student knows the use of standardized classification systems to name or identify objects, events, ideas, etc.	I U H	K2	3 4		2.1.3.1	
16. The student is able to identify objects, events, etc. according to standardized classifications and terminology (e.g., labeling specimens, locating events in time or space).	I U H	P31 P33	2 3			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.3 Classifying, categorizing, grouping, selecting according to criteria (Cont.)						
17. The student is able to distinguish between linear, two-dimensional, and multi-dimensional classification schemes (e.g., outline, grid, three-dimensional model).	U H	P33 P45	2 3			(V)Discrimination (V)Organization
18. The student is able to select and use classification schemes or models which are appropriate to the data being organized and to its intended use.	U H	P33 P65	2 3			(V)Organization (V)Resourcefulness (V)Utility (V)Discrimination
19. The student is able to modify classification schemes as needed to accommodate new or complex information.	P I U H	P33 P65	2 3 9			(V)Ingenuity (V)Organization (V)Accuracy
20. The student is able to modify classification schemes as needed to facilitate clarity and accuracy of communication.	P I U H	P33 P65	2 3 9			(V)Ingenuity (V)Organization (V)Communication

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.4 Ordering, sequencing						
1. The student is able to order similar objects in sequence, according to differences in an observable property (e.g., by size, shades of color, pitch or intensity of sound).	P I	P34	2 3			(V)Organization
2. The student is able to order information in a chronological sequence.	P I	P34	2 3			(V)Organization
3. The student is able to order words or phrases alphabetically.	P I	P34	2 3			(V)Organization
4. The student is able to order numerical symbols in sequence.	P I	P34	2 3			
5. The student is able to use accurate terms for time sequences or time relationships (e.g., then, now; before, during, after).	P I	P34 P66	2 3		2.1.1.1	(V)Organization
6. The student is able to use specific and descriptive terms for ordinal numbers (e.g., first, second, third; last).	P I	P34 P66	2 3			(V)Organization (V)Accuracy
7. The student is able to represent experimental or observational data in an appropriate sequence (e.g., time line, line graph).	P I U H	P34	2 3		2.1.3.3	(C)Data representation (V)Organization

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.5 Manipulating, arranging, transforming, computing						
1. The student is able to use effectively static and dynamic models for a variety of inquiry purposes (e.g., globe, molecular model).	P I U H	P35 P65	2 3		2.2.4	(C)Data representation (V)Resourcefulness (V)Utility (V)Inquiry
2. The student is able to select and use models appropriate to the subject and purpose of an inquiry.	P I U H	P35 P65	2 3		2.2.4	(V)Resourcefulness (V)Utility (V)Inquiry
3. The student is able to use accurately the measurement instruments needed in an inquiry.	P I U H	P35 P65	2 3		2.2.1	(C)Tools (V)Utility (V)Accuracy (V)Inquiry
4. The student is able to use laboratory equipment effectively and safely.	P I U H	P35 P65	2 3		2.2.2.2	(C)Tools (V)Utility (V)Inquiry (V)Physical well being
5. The student is able to use sense extending equipment effectively and safely.	P I U H	P16 P35 P65	2 3		2.2.2.1	(C)Tools (V)Utility (V)Inquiry (V)Physical well being
6. The student is able to organize efficiently the materials needed for research or study (e.g., resource books, lab materials, notebooks, files, study area).	P I U H	P35 P65	2	5		(V)Efficiency (V)Organization (V)Utility

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.5 Manipulating, arranging, transforming, computing (Cont.)						
7. The student is able to manipulate or arrange experimental or observational data according to an appropriate organizational scheme.	P I U H	P35	2 3		2.1.3.3 2.1.3.4	(C)Data representation (V)Organization (V)Inquiry
8. The student is able to use conventional mathematical operations needed to organize or interpret data.	P I U H	P35 P65	2 3	5		(C)Data representation (C)Data interpretation (V)Resourcefulness (V)Utility
9. The student is able to do accurate computations based on standardized formulas, equations, etc.	I U H	P35 P65	2 3	5		(V)Accuracy
10. The student is able to select and use appropriate resources and equipment to aid computation (e.g., tables, slide rules, calculators).	U H	P35 P65	2 3			(C)Tools (V)Resourcefulness (V)Utility (V)Efficiency
11. The student is able to translate information accurately from one form of representation to another (e.g., take notes from tape recording; translate words to numerical symbols, numerical symbols to words).	P I U H	P35	2 3	5		(V)Resourcefulness (V)Accuracy

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.5 Manipulating, arranging, transforming, computing (Cont.)						
12. The student is able to describe observations (e.g., translate from images to words).	P I	P35 P66	2 3		2.1.3.1	(C)Data representation (V)Communication
13. The student is able to use accurate terms, symbols, illustrations, or models to represent observations.	P I U H	P35 P66	2 3		2.1.3.1	(C)Data representation (V)Communication (V)Accuracy
14. The student knows differences between qualitative and quantitative description (e.g., qualitative-what's there; quantitative-how much, measured in definable units).	U H	K2 K5	3 4			(C)Data representation
15. The student knows reasons for use of standardized units of measurement for documentation of observations (e.g., communicability, efficiency).	P I U H	K7 K8	4	1		(C)Standardization
16. The student is able to use standardized units, terms, instruments, and procedures to document observations quantitatively.	P I U H	P35 P65	2 3		2.2.1	(C)Standardization (C)Measurement (V)Utility (V)Resourcefulness

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.6 Estimating						
1. The student knows meanings of the term "estimate" (e.g., tentative judgment; approximate determination prior to actual measurement).	I U H	K1 K2	3 4			
2. The student is able to make logical estimates based on available information.	P I U H	P36	2	4 5		
3. The student is able to revise or adjust estimates.	I U H	P36	2	4 5		
4. The student is able to distinguish between estimates and predictions (e.g., estimates are relatively rough approximations; predictions are based on accurate, systematic processing of valid data, mathematical projection, etc.).	I U H	P36 P45	2 3	5		
5. The student is able to estimate lengths of time.	P I U H	P36	2 3	5		
6. The student is able to estimate distances.	P I U H	P36	2 3	5		
7. The student knows ways in which logical estimations can add to the efficiency of one's research strategies (e.g., estimating location of book, rather than following sequence from beginning).	P I U H	K7 K8	3 4	1		(V)Efficiency

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.6 Estimating (Cont.)						
8. The student is able to estimate the location of a desired item in a sequentially arranged collection.	P I U H	P36	2 3	5		(V)Efficiency
9. The student is able to estimate outcomes or consequences of events or activities in a particular situation.	P I U H	P36	2	5		
10. The student is able to estimate results of calculations.	P I U H	P36	2 3	5		

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.3 Organizing information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.3.7 Summarizing, abstracting						
1. The student is able to abstract from resource materials the information relevant to the purpose or subject of an inquiry.	P I U H	P37	2	5		(V)Resourcefulness (V)Inquiry (V)Discrimination
2. The student is able to identify topic sentences, key words, etc., as an aid to abstracting or summarizing information.	P I U H	P37	2			(V)Utility (V)Efficiency
3. The student is able to abstract needed information from experimental or observational data.	P I U H	P37	2 3			(V)Utility (V)Inquiry (V)Efficiency
4. The student is able to summarize information from several sources.	P I U H	P37	2	5		(V)Resourcefulness (V)Inquiry (V)Efficiency
5. The student is able to summarize information contained in experimental or observational data.	P I U H	P37	2 3			(C)Data representation (V)Efficiency
6. The student is able to construct logical and coherent summaries.	P I U H	P37	2			(V)Utility (V)Clarity
7. The student is able to annotate summaries as needed to document sources of information (e.g., footnotes, bibliographic notes).	I U H	P37	2 3			(V)Utility (V)Integrity
8. The student is able to select and use conventional forms, materials, and procedures useful for storing and retrieving summarized or abstracted information (e.g., index cards, notebooks, tapes).	I U H	P37	2 3			(V)Resourcefulness (V)Efficiency

2. Processes and science

2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4 Interpreting information						
1. The student knows the location and use of print and nonprint materials related to interpreting information (e.g., SUBJECT GUIDE TO BOOKS IN PRINT: "Decision Making," "Testing," "Inference-Logic," "Interpolation"; READER'S GUIDE: "Measurement"; LEARNING DIRECTORY: "Interpretation Skills," "Interpolation," "Decoding," "Discrimination").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.1 Decoding verbal and nonverbal symbols						
1. The student is able to decode accurate information from written or printed words.	P I U H	P41	2 3	5		(C)Data representation (V)Accuracy (V)Communication
2. The student is able to decode accurate information from written or printed numerical symbols.	P I U H	P41	2 3	5		(C)Data interpretation (V)Accuracy (V)Communication
3. The student is able to decode accurate information from written or printed scientific or algebraic notation.	I U H	P41	2 3	5		(C)Data interpretation (V)Accuracy (V)Communication
4. The student is able to decode accurate information from graphic representations such as maps, graphs, charts, etc.	P I U H	P41	2 3	5		(C)Data interpretation (V)Accuracy (V)Communication
5. The student is able to decode accurate information from three-dimensional models.	P I U H	P41	2 3	5		(C)Data interpretation (V)Accuracy (V)Communication
6. The student is able to decode accurate information from imagerial representations (e.g., pictures, illustrations, films).	P I U H	P41	2 3	5		(C)Data interpretation (V)Accuracy (V)Communication

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.1 Decoding verbal and nonverbal symbols (Cont.)						
7. The student is able to decode accurate information from spoken words.	P I U H	P41	2 3	5	2.1.7.2	(C)Data interpretation (V)Accuracy (V)Communication
8. The student is able to decode accurate information from behavior (e.g., gestures, actions, expressions).	P I U H	P41	2	5	2.1.7.2	(C)Data interpretation (V)Accuracy (V)Communication
9. The student is able to decode accurate information from electronic representations (e.g., computer, spectroscope, telegraph).	U H	P41	2 3	5	2.1.7.3	(C)Data interpretations (V)Accuracy (V)Communication

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.2 Inferring, interpolating, extrapolating						
1. The student is able to draw logical inferences from observations or representations.	P I U H	P42	2 3	5		(C)Data interpretation (V)Rationality (V)Inquiry
2. The student is able to draw inferences that account for all factors in a situation.	P I U H	P42	2 3	5		(V)Rationality (V)Accuracy (V)Inquiry
3. The student is able to distinguish between inference, prediction, and hypothesis.	U H	P42 P45	2 3			(V)Discrimination
4. The student is able to infer sequences of events from illustration or descriptive data.	P I	P42	2 3			(C)Data interpretation (V)Rationality (V)Organization (V)Accuracy
5. The student is able to infer possible causes of an observed or represented effect.	P I U H	P42	2	5		(V)Rationality (V)Inquiry
6. The student is able to infer possible effects of an observed or represented phenomena.	P I U H	P42	2	5	2.1.3.6	(V)Rationality (V)Inquiry
7. The student is able to distinguish between logical and illogical inferences.	P I U H	P42 P45	2	5		(V)Discrimination (V)Rationality
8. The student is able to distinguish between the possible and the likely in a particular situation.	P I U H	P42 P45	2	5		(V)Discrimination (V)Rationality

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.2 Inferring, interpolating, extrapolating (Cont.)						
9. The student knows that interpolation and extrapolation involve the inferring and projection of trends sequentially from organized data.	U H	K2	3 4			(C)Data interpretation
10. The student is able to distinguish between interpolation and extrapolation.	U H	P42 P45	2 3			(C)Data interpretation (V)Discrimination
11. The student is able to construct accurate interpolations of observational or experimental data.	U H	P42	2 3			(V)Accuracy (V)Inquiry
12. The student is able to construct accurate extrapolations of observational or experimental data.	U H	P42	2 3			(V)Accuracy (V)Problem solving (V)Prediction
13. The student is able to select and use appropriate conventional aids to accurate interpolation or extrapolation of data (e.g., calculators, slide rules, reference tables, computers).	H	P42 P65	2 3		2.2.2.3	(C)Tools (V)Resourcefulness (V)Utility (V)Efficiency (V)Accuracy
14. The student is able to calculate mathematical probabilities.	H	P42	2 3		5.17	(C)Information (V)Resourcefulness (V)Prediction (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.3 Analyzing						
1. The student knows that analysis is the study of a whole by systematic examination of its parts and the relationships between them.	I U H	K1 K2	3 4		2.1.5.2	(C)Analysis
2. The student knows that scientists, scholars, philosophers, etc. use various models or systems to analyze the subjects of their inquiries.	I U H	K2 K7	4	1		(C)Analysis
3. The student is able to identify constituent parts of a whole.	I U H	P43	2 3			(C)Systems (V)Inquiry (V)Organization
4. The student is able to use a conventional model or system as a basis for analysis of objects, materials, events, etc.	I U H	P43	2 3			(V)Resourcefulness (V)Utility (V)Inquiry
5. The student is able to use accurate terms for analytical systems, models, or procedures (e.g., quantitative, qualitative; static, dynamic; systems analysis; statistical analysis; chemical analysis; linguistic analysis).	U H	P43 P65	2 3		2.1.5.2	(V)Accuracy (V)Utility (V)Inquiry (V)Discrimination
6. The student is able to select and use criteria appropriate to the subject and purpose of an analysis.	U H	P33 P43 P65	2 3		2.1.2.4	(V)Resourcefulness (V)Discrimination (V)Inquiry
7. The student knows procedures involved in analysis of data (e.g., organizing, relating, comparing, interpolating, extrapolating).	U H	K2	3 4			(C)Data interpretation

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.3 Analyzing (Cont.)						
8. The student is able to analyze experimental or observational data according to selected or specified procedures and criteria.	U H	P43 P65	2 3			(C)Data interpretation (V)Inquiry (V)Competence
9. The student is able to select and use effectively technological aids to analysis (e.g., lab equipment, data processing equipment, measurement instruments, dynamic models).	U H	P33 P43 P65	2 3			(C)Tools (V)Resourcefulness (V)Discrimination (V)Inquiry
10. The student is able to analyze observed or represented interactions within a system.	P I U H	P43	2 3			(V)Inquiry (V)Resourcefulness
11. The student is able to analyze the composition of materials or objects.	P I U H	P43	2 3			(V)Inquiry (V)Resourcefulness
12. The student is able to analyze distributions of factors in a system.	I U H	P43	2 3			(V)Inquiry (V)Resourcefulness
13. The student is able to analyze trends or sequences.	I U H	P42 P43	2 3			(V)Inquiry (V)Resourcefulness
14. The student is able to analyze statements of ideas.	I U H	P43	2 3		1.1.3 2.1.2.2	(V)Critical judgment (V)Rationality (V)Problem solving

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.4 Associating, relating, equating						
1. The student is able to relate causes and effects (or actions, outcomes, and consequences) accurately and adequately for a situation.	P I U H	P44	2			(V)Accuracy (V)Inquiry
2. The student is able to relate defined concepts accurately and adequately (e.g., structure/function; energy/entropy; space/time).	I U H	P44	2 3			(V)Accuracy (V)Mastery
3. The student is able to relate terms or symbols accurately to formal and personal definitions.	P I U H	P44	2 3			(V)Accuracy (V)Mastery
4. The student is able to associate or relate accurately data about real factors in a situation.	P I U H	P44	2 3			(V)Accuracy (V)Inquiry
5. The student is able to relate, associate, and equate data about a situation represented in different forms (e.g., picture with written description; verbal definition with equation).	P I U H	P44	2 3			(V)Accuracy (V)Resourcefulness (V)Inquiry
6. The student is able to relate accurately data from various sources.	P I U H	P44	2 3			(V)Accuracy (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.4 Associating, relating, equating (Cont.)						
7. The student is able to associate or relate extensions of representations with their bases and their implications (e.g., hypotheses, predictions, extrapolations; theoretical mathematics, statistics, literary or artistic fantasy).	U H	P44	2 3			(C)Theory (V)Inquiry
8. The student is able to use conventional operations and procedures to accurately relate, associate, and equate information (e.g., mathematics, experimentation, logic, analytic models).	I U H	P44 P65	2 3			(V)Resourcefulness (V)Utility (V)Accuracy (V)Inquiry
9. The student is able to relate principles, definitions, concepts, or theories to accurate examples or analogies.	P I U H	P44	2 3			(V)Accuracy (V)Mastery
10. The student is able to relate information about situations to appropriate criteria for acting or deciding.	I U H	P24 P44	2 3		2.1.2.4	(V)Discrimination (V)Decision making
11. The student is able to associate or equate accurately personal observations or perceptions with the observations or perceptions communicated by others (e.g., recognize common feelings, impressions, ideas; recognize reasons for differences in reported observations, feelings, impressions).	P I U H	P44 P63	2 3 7	2 5	2.1.1.1	(C)Communication (V)Accuracy (V)Perception (V)Perspective

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.4 Associating, relating, equating (Cont.)						
12. The student is able to associate knowledge from various disciplines to related aspects of his or her own self-knowledge (e.g., use principles, models, terms as basis for examining and interpreting personal needs, values, responses, abilities, limitations).	I U H	P44 P63 P64	2 5 7	2 5		(V)Self-knowledge (V)Insight (V)Resourcefulness

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.5 Comparing, contrasting, discriminating, measuring						
1. The student knows that selectivity occurs consciously and unconsciously in human information processing.	I U H	G1 K3	4	2	3.2.2 3.2.4.3	(C)Information (C)Behavior (V)Perception (V)Discrimination
2. The student knows the meaning of selectivity in responses of organisms to stimuli.	I U H	K2	4			
3. The student knows that selectivity which operates on the conscious level involves processes of comparing, contrasting, and discriminating.	I U H	G2 K7	4			(V)Self-knowledge (V)Discrimination
4. The student knows ways of refining the accuracy and usefulness of one's comparisons and discriminations (e.g., measurement, documentation; use of accurate comparative terms, problem solving procedures).	I U H	K2	3 4	5		(V)Accuracy (V)Utility (V)Discrimination (V)Growth and development
5. The student knows that comparing, contrasting, and discriminating are key processes at all stages of inquiry or problem solving (e.g., acquiring, evaluating, organizing, interpreting, and applying information; deciding, acting, communicating).	I U H	G2 K7	4			(V)Discrimination (V)Inquiry (V)Intellect

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.5 Comparing, contrasting, discriminating, measuring (Cont.)						
6. The student is able to compare physical properties of objects.	P I U H	P45	2			(V)Discrimination
7. The student is able to represent comparisons in a variety of forms (e.g., verbal description, illustration, measurement unit).	P I U H	P45 P66	2 3			(C)Data representation (V)Resourcefulness (V)Utility (V)Discrimination
8. The student is able to use comparative terms (e.g., greater than, less than; larger, smaller; older, newer).	P I	P45 P65	2 3			(V)Accuracy (V)Discrimination
9. The student is able to identify similarities and differences in objects, representations, concepts, etc.	P I	P33 P45	2 3		2.1.3.3	(V)Discrimination
10. The student is able to use conventional systems for documenting or quantifying comparisons (e.g., standardized measurements, classifications, vocabulary).	P I U H	P45	2 3	5		(V)Utility (V)Resourcefulness (V)Discrimination
11. The student is able to make logical distinctions.	P I U H	P45	2	5		(V)Rationality (V)Discrimination

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.5 Comparing, contrasting, discriminating, measuring (Cont.)						
12. The student is able to compare and contrast experimental or observational data from several sources.	P I U H	P45	2 3			(V)Discrimination (V)Resourcefulness
13. The student is able to compare predictions with outcomes.	P I U H	P45	2	5		(V)Discrimination (V)Critical judgment
14. The student is able to compare prior assumptions with new information.	P I U H	P45	2	2 5		(V)Discrimination (V)Critical judgment
15. The student is able to distinguish between representations which meet selected or given criteria and those which do not.	P I U H	P45	2	5		(V)Discrimination (V)Critical judgment
16. The student is able to compare theories, models, or frames of reference.	I U H	P45	2 3	5		(C)Theory (V)Discrimination (V)Critical judgment

2. Processes and science
2.1. Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.6 Synthesizing						
1. The student knows that synthesis is the process of building a new whole out of separate parts.	I U H	K1 K2	3 4			(V)Unity (V)Diversity
2. The student is able to synthesize a representation of a whole from experimental or observational data about its parts or factors.	I U H	P46	2 3			(V)Unity (V)Diversity (V)Ingenuity
3. The student is able to discover new information from reorganization of data about related factors (e.g., relating, synthesizing).	I U H	P46	2 7	5		(V)Insight (V)Creativity (V)Organization (V)Interrelatedness
4. The student is able to use mathematical operations accurately for synthesizing a multi-dimensional measurement from single-dimension measurements (e.g., determine volume from linear measurements; calculate scalar quantities).	P I U H	P46 P65	2 3			(V)Accuracy (V)Resourcefulness
5. The student is able to select and use standard forms and operations which are appropriate to the subject and purpose of a synthesis.	U H	P33 P46 P65	2 3		2.1.2.3 2.1.2.4	
6. The student is able to use personal ingenuity in synthesizing a representation from varied data.	I U H	P46	2 7 8			(V)Ingenuity (V)Self-direction

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting informatio

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.6 Synthesizing (Cont.)						
7. The student is able to synthesize information into representations which are accurate, adequate, and relevant to the reality they represent.	P I U H	P46	2 3			(V)Accuracy (V)Completeness (V)Rationality
8. The student knows that synthesizing is a key process in the formation of generalizations, conclusions, hypotheses, decisions, etc.	I U H	K7	4			(V)Intellect (V)Inquiry
9. The student is able to synthesize information about a situation and about oneself for problem solution or decision making.	I U H	P46	2 5			(V)Self-knowledge (V)Decision making (V)Problem solving
10. The student knows relationships between analysis and synthesis as processes of inquiry.	I U H	K10	3 4		1.3	(V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.7 Testing against standards or criteria						
1. The student knows meanings of the term "criteria" (e.g., standards, principles, indicators).	P I U H	K1 K2	3 4			
2. The student knows that humans use criteria at all levels of information processing (e.g., unconscious selectivity in perception, response, retention of information; conscious selectivity in organizing, evaluating, interpreting, acting on information).	I U H	G2 K7	4		3.2.4.3	(C)Information (C)Behavior
3. The student knows that criteria vary in levels of generality or specificity (e.g., levels of classification scheme; concept of accuracy vs. specification of tolerances for particular measurements).	I U H	G2 K5	4			
4. The student is able to use effectively standardized or conventional criteria for organizing and interpreting information (e.g., classifying, measuring, analyzing, discriminating).	P I U H	P47	2 3			(V)Efficiency (V)Resourcefulness (V)Inquiry
5. The student is able to test representations of information against conventional scientific criteria (e.g., accuracy, adequacy, relevance).	P I U H	P47	2 3	5	2.1.2 2.1.5.1	(V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.7 Testing against standards or criteria (Cont.)						
6. The student is able to test the validity of represented information (e.g., experimentation; hypothesis testing).	P I U H	P47	2 3	5	2.1.2	(V)Prediction (V)Inquiry
7. The student is able to test the validity of experimental or observational data against specified criteria.	P I U H	P47	2			
8. The student is able to determine criteria by which the accuracy of personal observations may be tested.	P I U H	P47	2			
9. The student is able to test the accuracy of personal observations against selected criteria.	P I U H	P47	2			
10. The student knows that value principles function as criteria for human decisions.	I U H	G2 K7	4		1.1.3	(V)Decision making
11. The student is able to select and use value principles which are appropriate to the situation in which a decision is made.	I U H	P33 P47 P64	2		1.1.3	(V)Decision making (V)Problem solving
12. The student is able to test alternative solutions or decisions against personally selected criteria.	I U H	P47	2 5			(V)Decision making (V)Problem solving

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.7 Testing against standards or criteria (Cont.)						
13. The student is able to state the criteria by which he or she is testing information.	P I U H	P47 P66	2 5			(V)Decision making (V)Inquiry (V)Clarity
14. The student is able to select and use appropriate conventional methods, materials, and instruments for testing representations against stated criteria.	I U H	P47 P65	2 3			(V)Inquiry (V)Utility (V)Resourcefulness

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.8 Generalizing						
1. The student knows that generalizations are abstractions (i.e., statements about relationships between concepts or represented factors).	I U H	K2	3 4			
2. The student knows various kinds of generalizations, including scientific laws, principles, value judgments, conclusions.	I U H	K5	3 4			
3. The student is able to formulate logical generalizations from experimental or observational data.	I U H	P48	2 5			(V)Rationality
4. The student is able to draw accurate, relevant conclusions about relationships within a situation.	P I U H	P48	2 5	5		(V)Accuracy (V)Rationality
5. The student knows that the process of deriving a generalization from interpretations of information is called induction (e.g., inductive logic, inductive reasoning).	H	K2	3 4			(V)Inquiry
6. The student knows that the process of applying generalizations to the interpretation of information is called deduction (deductive reasoning, deductive logic).	H	K2	3 4			(V)Inquiry
7. The student is able to apply generalizations which are appropriate to the subject and purpose of a deductive inquiry.	H	P48	2			(V)Discrimination (V)Inquiry

SCIENCE

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.4 Interpreting information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.4.8 Generalizing (Cont.)						
8. The student is able to formulate logical generalizations or conclusions from extensions of representations (e.g., extrapolated statistics, higher mathematics, theoretical models).	H	P48	2			(V)Rationality (V)Prediction (V)Inquiry
9. The student knows ways in which generalizing relates to other inquiry processes (e.g., abstracting, summarizing, inferring, associating, synthesizing, hypothesizing).	H	K10	4			(V)Inquiry (V)Intellect
10. The student is able to state tentative generalizations (i.e., hypotheses) to be tested in a particular inquiry.	P I U H	P48 P66	2 3		2.1.5.1	(V)Inquiry (V)Clarity
11. The student is able to withhold judgments or conclusions until adequate information has been validated.	P I U H	P63	2	5	2.1.2.4	(V)Critical judgment

2. Processes and science
2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5 Using information to produce new information						
1. The student knows the location and use of print and nonprint materials related to using information to produce new information (e.g., card catalog: "Scientific Method," "Logic"; SUBJECT GUIDE TO BOOKS IN PRINT: "Systems Analysis," "Problem Solving," "Logic," "Induction-Logic"; READER'S GUIDE: "Methodology," "Systems Analysis"; LEARNING DIRECTORY: "Scientific Method," "Problem Solving," "Conflict Resolution," "Systems Analysis," "Logic"; area and building audiovisual catalogs: "Research").	I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.1 Scientific method						
1. The student knows that the classic "scientific method" refers to the sequence of processes common to most inquiry strategies (i.e., definition, hypothesis, prediction, testing, interpretation, evaluation, generalization, construction of theory).	I U H	K1 K7	3 4			(C)History of science (V)Inquiry
2. The student knows that the scientific method has been developed as a means of validating new information and of reconciling conflicting information.	I U H	K4 K7	4		2.1.2	(C)History of science (V)Inquiry
3. The student is able to define a problem or question to be investigated.	P I U H	P66	2			(V)Inquiry (V)Clarity
4. The student is able to identify variables.	I U H	P52	2			(V)Inquiry (V)Clarity
5. The student is able to formulate hypotheses (e.g., logical generalizations about relationships between variables or factors in a situation).	I U H	P52	2 3			(V)Inquiry (V)Ingenuity (V)Rationality
6. The student is able to identify principles or postulates upon which a hypothesis is based.	I U H	P52	2 3		2.2.3	(V)Inquiry (V)Rationality
7. The student is able to make logical predictions based on a hypothesis.	I U H	P51	2			(V)Inquiry (V)Rationality

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.1 Scientific method (Cont.)						
8. The student is able to design a test to prove a hypothesis (e.g., controlled experiment, observation, survey).	P I U H	P53	2 3			(V)Inquiry
9. The student is able to state predicted outcomes of a hypothesis test.	P I U H	P51 P53	2 3			(V)Prediction (V)Clarity
10. The student is able to state criteria by which test data will be evaluated.	P I U H	P53 P66	2 3			(V)Inquiry (V)Clarity (V)Discrimination
11. The student is able to select and use appropriate procedures, instruments, and materials to test a hypothesis.	P I U H	P33 P53	2 3	5	2.2	(V)Inquiry (V)Resourcefulness (V)Utility
12. The student is able to carry out controlled experiments.	P I U H	P53	2 3			(V)Inquiry (V)Self-direction
13. The student knows that in a controlled experiment all variables are held constant except the one whose effect is being tested.	P I U H	K2	3 4			
14. The student is able to construct matching control and test situations for comparative experiments (e.g., match distribution of variables, number of subjects).	U H	P53	2 3			(V)Inquiry (V)Resourcefulness (V)Accuracy

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.1 Scientific method (Cont.)						
15. The student is able to select appropriate experimental samples or subjects to test a hypothesis (e.g., relevant to the hypothesis; accurately represent factors being tested for).	P I U H	P33 P53	2 3			(V)Inquiry (V)Discrimination
16. The student is able to collect valid baseline data from which to measure change (e.g., document existing conditions in all variables).	P I U H	P32 P53	2 3		2.1.3	(C)Measurement (C)Data representation (V)Inquiry (V)Accuracy
17. The student is able to document changes observed during a controlled experiment.	P I U H	P32 P53	2 3		2.1.3	(C)Data representation (V)Inquiry (V)Resourcefulness (V)Accuracy
18. The student is able to carry out structured observations to test a hypothesis (e.g., behavioral observation, field study).	P I U H	P53	2 3	5		(V)Inquiry (V)Self-direction
19. The student is able to conduct a survey to test a hypothesis.	I U H	P53	2 3	5		(V)Inquiry (V)Self-direction
20. The student is able to duplicate experiments designed by others (e.g., demonstrate test of a classic hypothesis; follow directions from text or lab manual).	I U H	P53	2 3		7.2	(V)Inquiry (V)Insight (V)Respect for others

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.1 Scientific method (Cont.)						
21. The student is able to design and conduct tests of personally developed hypotheses.	P I U H	P53	2 3 5 9	5		(V)Inquiry (V)Self-direction (V)Ingenuity
22. The student is able to select and use appropriate instruments and procedures to organize and interpret test data.	I U H	P53	2 3			(C)Data interpretation (V)Inquiry (V)Resourcefulness (V)Utility
23. The student is able to recognize test data which supports a hypothesis (e.g., documents occurrence of predicted outcomes).	P I U H	P45 P53	2 3			(C)Data interpretation (V)Inquiry (V)Discrimination
24. The student is able to evaluate test results according to criteria specified in the test design.	I U H	P47 P53	2 3			(C)Data interpretation (V)Inquiry (V)Consistency (V)Discrimination
25. The student is able to adapt or modify hypotheses as needed to reconcile conflicting or inconclusive data.	P I U H	P54	2			(V)Inquiry (V)Rationality (V)Accuracy (V)Consistency (V)Flexibility
26. The student is able to state conclusions or generalizations drawn from test data.	P I U H	P48 P54	2 3	5		(V)Inquiry (V)Clarity (V)Communication

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.1 Scientific method (Cont.)						
27. The student is able to construct theories based on validated principles, data and hypotheses.	I U H	P51	2 3			(C)Theory (V)Inquiry (V)Ingenuity (V)Rationality
28. The student is able to make valid predictions from theories.	I U H	P51	2 3			(C)Theory (V)Prediction (V)Accuracy
29. The student is able to use accurately the conventional vocabulary and instruments of scientific experimentation.	I U H	P66	3		2.2 7.2	(V)Communication (V)Accuracy (V)Resourcefulness (V)Utility

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.2 Problem solving models						
1. The student is able to select and use appropriate methods of problem solving models for specific tasks (e.g., systems analysis, conflict resolution, force field analysis, logic, mathematics).	I U H	P33 P63	2 3 5	4 5		(V)Problem solving (V)Resourcefulness (V)Utility (V)Self-direction
2. The student is able to use force field analysis for problem solving.	I U H	P63	2 3 5	5		(V)Problem solving (V)Utility
3. The student knows that force field analysis includes: (1) stating a problem, (2) identifying positive and negative forces that affect the problem, (3) assessing the problem statement to see if it is correctly specified, (4) seeking solutions to the problem once the true problem has been identified.	I U H	K2	3 4			
4. The student is able to use gaming techniques for solving problems (e.g., simulation, role playing).	P I U H	P63 P65	2 3 5	5		(V)Problem solving (V)Utility
5. The student knows that a game is an activity undertaken by a player or players whose actions are constrained by a set of explicit rules particular to that game and by a predetermined end point (e.g., card games, checkers).	P I U H	K2	3 4			

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.2 Problem solving models (Cont.)						
6. The student knows that nongames are not "played"; they are governed by implicit rules of general applicability and have no easily defined ending (e.g., role playing).	P I U H	K2	3 4			
7. The student knows that a simulation game is a model of some external reality with which the players interact as they would in actual situations (e.g., Monopoly is a simulation of the real estate business).	I U H	K2	3 4			
8. The student is able to act out an assigned role in a role playing situation.	P I U H	P77	2 5	2 5		(V)Problem solving (V)Empathy (V)Self-discipline (V)Creativity
9. The student is able to act out an unassigned role (i.e., free to pretend to be whomever he or she wishes) in a role playing situation.	P I U H	P77	2 5	2 5		(V)Problem solving (V)Self-expression (V)Fantasy (V)Creativity
10. The student is able to design games for problem solving.	P I U H	P67	2 5 8			(V)Problem solving (V)Creativity
11. The student is able to use a systems analysis model for inquiry or problem solving.	I U H	P65	2 3 5	5		(V)Inquiry (V)Problem solving (V)Utility

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.2 Problem solving models (Cont.)						
12. The student knows principles upon which systems analysis procedures are based (e.g., existence of systems; commonalities between technological and natural systems; utility of describing wholes in terms of interactions between their parts; need to identify all factors and relationships accurately before deciding or acting).	I U H	G1 K2 K9	3 4			(C)Systems
13. The student knows meanings of terms used in systems analysis, including whole, elements, objectives, constraints, negative and positive feedback, duration, steady-state, equilibrium, equifinality.	I U H	K1 K2	3 4			(C)Systems
14. The student is able to identify various kinds of systems (e.g., closed, open, isolated, homeostatic).	I U H	P45	2 3		3.4	(C)Systems (V)Discrimination
15. The student is able to use conventional procedures of systems analysis: state needs, define objectives, identify constraints, review alternatives, select alternatives which best meet need, implement alternative, receive feedback, evaluate, modify procedures until objectives are met satisfactorily.	I U H	P65	2 3 5			(C)Systems (V)Utility (V)Problem solving

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.2 Problem solving models (Cont.)						
16. The student is able to use effectively a conventional model for resolution of personal or social conflicts (e.g., J. P. Shaver's conflict resolution model; value clarification strategies; conflict analysis strategies).	P I U H	P65	2 3 5	4 5	1.1	(V)Problem solving (V)Utility
17. The student is able to select and use appropriate resources for analyzing and resolving personal conflicts (e.g., counselors, publications, programmed materials).	I U H	P33 P63 P65	2 5	1 5	2.1.2 8.5	(V)Problem solving (V)Resourcefulness (V)Utility
18. The student is able to use effectively instruments, procedures and activities designed to aid resolution of interpersonal or intergroup conflicts (e.g., issue analysis, role playing, structured group experiences).	I U H	P63 P65	2 3 5	4 5	1.1 2.1.7	(V)Problem solving (V)Resourcefulness (V)Utility
19. The student is able to use principles and operations of formal logic at appropriate stages of a problem solving or inquiry strategy.	H	P63	2 3 5			(V)Problem solving (V)Inquiry (V)Utility (V)Rationality
20. The student knows terms, principles, and operations of formal logical analysis.	H	G1 K1 K2	3 4			(V)Rationality

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.5 Using information to produce new information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.5.2 Problem solving models (Cont.)						
21. The student is able to use mathematical symbols, principles, and operations at appropriate stages of a problem solving or inquiry strategy.	P I U H	P63	2 3 5	4 5		(V)Problem solving (V)Inquiry (V)Resourcefulness (V)Utility
22. The student is able to determine the effectiveness of strategies and models used to solve a problem.	P I U H	P24 P63	2 5			(V)Problem solving (V)Inquiry (V)Efficiency (V)Discrimination
23. The student is able to adapt or modify conventional problem solving models to meet situational needs.	P I U H	P63	2 5 8			(V)Problem solving (V)Inquiry (V)Resourcefulness (V)Creativity

2. Processes and science

2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6 Acting on the basis of information--decision making						
1. The student knows the location and use of print and nonprint materials related to decision making (e.g., card catalog: "Behavior," "Creation," "Logic, Symbolic and Mathematical"; SUBJECT GUIDE TO BOOKS IN PRINT: "Decision Making," "Symbolism," "Audio-Visual Materials," "Knowledge, Theory of," "Creation-Literary, Artistic, etc.," "Graphic Methods"; READER'S GUIDE: "Audiovisual Aids," "Symbols," "Behavior"; LEARNING DIRECTORY: "Values," "Process Control," "Goal Achievement," "Decision Making").	I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.6 Acting on the basis of information--decision making

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6.1 Restructuring values (see also 1.1 Value clarification)						
1. The student is able to restructure personal values in response to new information about oneself and about real situations.	P I U H	P64	2 5 9	4 5	2.1.2.4	
2. The student is able to use appropriate conventional models or strategies for clarification or analysis of personal values.	P I U H	P64	2 3 5	4 5		

2. Processes and science
2.1 Universal inquiry-problem solving processes.
2.1.6 Acting on the basis of information--decision making

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6.2 Restructuring behavior (see also 3.2.4.3 Human behavior)						
1. The student is able to alter his or her behavior in response to new information about self or situations.	P I U H	P65	2 6	4 5		(C)Behavior (V)Self-direction (V)Growth and development
2. The student is able to alter his or her behavior to match changing personal values or needs.	P I U H	P65	2 6	4 5		(C)Behavior (V)Self-direction (V)Growth and development (V)Consistency
3. The student is able to select and use appropriate models or strategies to analyze personal behavior (e.g., transactional analysis, behavioral psychology, psychoanalytic theory, information system model).	U H	P33 P65	2 3			(C)Behavior (V)Resourcefulness (V)Utility (V)Self-knowledge
4. The student is able to use accurately the conventional terms associated with a conventional model for analysis of personal behavior.	U H	P65 P66	2 3 5		2.2.2	(C)Behavior (V)Accuracy (V)Utility (V)Problem solving
5. The student is able to recognize behavior patterns.	P I U H	P42	2	2 5		(C)Behavior (V)Insight
6. The student is able to recognize changes in behavior patterns.	P I U H	P42 P45	2	2 5		(C)Behavior (V)Insight

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.6 Acting on the basis of information--decision making

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6.2 Restructuring behavior (Cont.)						
7. The student is able to document observed changes in personal behavior (e.g., data showing use of specific skills; changed patterns of social interaction).	P I U H	P32	2 3	5		(C)Measurement (C)Behavior (V)Accuracy (V)Self-knowledge
8. The student is able to design and carry out a plan to modify a personal behavior pattern (e.g., state need, behavior to be modified, program to be followed; document change, evaluate results).	I U H	P65	2 3 5	5		(V)Self-direction (V)Self-fulfillment (V)Self-discipline (V)Resourcefulness (V)Ingenuity
9. The student knows ways in which behavior changes are related to growth of personal knowledge and skills.	I U H	K8 K10	1 4	5		(C)Behavior (V)Knowledge

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.6 Acting on the basis of information--decision making

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6.3 Encoding verbal and nonverbal symbols prior to communication						
1. The student knows that accurate encoding of information requires use of a coding system which is known by both sender and receiver and is adequate to represent the information.	P I U H	G2 K9	3 4		2.1.7	(V)Communication (V)Accuracy
2. The student is able to select and use appropriate symbols for accurate encoding of information (e.g., conveys intended meaning to receiver).	P I U H	P33 P66	2 3	5		(V)Communication (V)Accuracy (V)Utility (V)Resourcefulness
3. The student is able to encode information accurately into conventional written or printed symbols (e.g., words, numerals, scientific notation).	P I U H	P66	2 3	5		(V)Communication (V)Accuracy
4. The student is able to use effectively various nonprint forms for encoding information (e.g., computer language, audiovisuals).	I U H	P66 P67	2 3		2.1.6.4	(V)Communication (V)Resourcefulness
5. The student is able to "think before he speaks," or before he writes.	P I U H	P24 P65 P66	2	5		(V)Communication (V)Self-discipline
6. The student is able to determine an appropriate style, format, level of difficulty, etc. for communicating information in a particular situation.	I U H	P24 P45 P66	2 3	5		(V)Communication (V)Discrimination (V)Critical judgment

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.6 Acting on the basis of information--decision making

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6.4 Creating on the basis of knowledge and process						
1. The student is able to construct models.	P I U H	P67 P76	2 8		2.2.4	(V)Creativity
2. The student is able to use art forms to communicate information (e.g., paintings, photography, sculpture).	P I U H	P76	2 8			(V)Creativity (V)Communication (V)Self-expression
3. The student is able to use literary forms to communicate information.	P I U H	P75	2 8			(V)Creativity (V)Communication (V)Self-expression
4. The student is able to use dramatizations to communicate information.	P I U H	P77	2 8			(V)Creativity (V)Communication (V)Self-expression
5. The student is able to use dance forms to express or communicate information.	P I U H	P79	2 8			(V)Creativity (V)Communication (V)Self-expression
6. The student is able to use music as a media for communication (e.g., using music of others; creating his or her own music).	P I U H	P78	2 8			(V)Creativity (V)Communication (V)Self-expression
7. The student is able to manipulate objects into a variety of positions or designs.	P I U H	P67	2 8			(V)Creativity (V)Ingenuity
8. The student is able to draw representations of observations.	P I U H	P67 P76	2 8			(C)Data representation (V)Creativity

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.6 Acting on the basis of information--decision making

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.6.4 Creating on the basis of knowledge and process (Cont.)						
9. The student is able to imagine or visualize extensions of representations.	P I U H	P67	2 8			(V)Creativity (V)Interest (V)Fantasy
10. The student is able to initiate ideas, procedures, activities, etc. related to an inquiry or problem solving situation.	P I U H	P67	2 8			(V)Creativity (V)Ingenuity
11. The student is able to design and follow a course of personal action.	P I U H	P65 P67	2 5 8		2.1.6.2	(V)Creativity (V)Self-direction (V)Self-discipline

2. Processes and science

2.1 Universal inquiry-problem solving processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7 Communicating information						
1. The student knows the location and use of print and nonprint materials related to communicating information (e.g., card catalog: "Telstar Project," "Television Broadcasting," "Communication"; SUBJECT GUIDE TO BOOKS IN PRINT: "Communication of Technical Information," "Human Communication," "Report Writing," "Television Broadcasting," "Radio Broadcasting"; READER'S GUIDE: "Communication Satellites," "Communication-Social Aspects"; LEARNING DIRECTORY: "Communication, Development," "Communication, Mass," "Information Systems," "Information Dissemination"; area and building audiovisual catalogs: "Information Storage and Retrieval Systems," "Telecommunication").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.1 Giving information (see also 2.1.6.3 Encoding verbal and nonverbal symbols prior to communication)						
1. The student is able to write reports according to specified criteria.	P I U H	P66 P75	2 3	5		(V)Communication
2. The student is able to give directions clearly and accurately.	P I U H	P74	2 3	5		(V)Communication (V)Clarity (V)Accuracy
3. The student is able to demonstrate or dramatize effectively information acquired through inquiry.	P I U H	P72 P77	2 3	5		(V)Communication
4. The student is able to give oral reports clearly and accurately.	P I U H	P74	2 3	5		(V)Communication (V)Clarity (V)Accuracy
5. The student is able to select and use appropriate audiovisual aids for communicating information to a group of people.	P I U H	P33 P74 P76	2 3	5		(V)Communication (V)Resourcefulness

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.1 Identifying communication problems						
1. The student is able to identify factors which contribute to inaccuracy, inadequacy, or irrelevance in communications between individuals.	P I U H	P45	2 5	2 5		(V)Communication (V)Accuracy (V)Completeness
2. The student is able to select and use an appropriate model for analyzing communication problems (e.g., communication system model).	I U H	P33 P45	2 3 5			(V)Communication (V)Discrimination (V)Resource-fulness (V)Utility
3. The student is able to identify limitations of verbal coding (language).	I U H	P48	1 2 3			(V)Communication (V)Discrimination
4. The student knows that words have different associations for different people.	P I U H	G2 K1	3 4	5		(V)Communication
5. The student knows that spoken words must be decoded as part of a larger system which includes tone of voice, gestures, and unstandardized cues.	P I U H	G2 K1	3 4	5		(V)Communication (V)Completeness
6. The student knows that a word may have several unrelated definitions (e.g., run = human activity, machine activity, arrangement of cards, characteristic defect of nylon stockings, place for animals to exercise, etc.)	P I U H	G2 K1	3 4	5		(V)Communication

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.1 Identifying communication problems (Cont.)						
7. The student knows that concept may be represented by several words, some of which have shades of meaning which must be inferred from familiarity with general usage (e.g., alone, solo, solitary, isolated).	P I U H	G2 K1	3 4	5		(V)Communication (V)Diversity
8. The student is able to identify limitations of the English language as a code (e.g., personal perceptions, judgments, or feelings are often expressed as qualities of object observed: "It's cold" for "I feel cold"; "that's pretty"; "he's a prude").	I U H	P48	1 2 3	5		(V)Communication (V)Perception
9. The student is able to use appropriate terms for identifying communication problems (e.g., interpersonal gap; misunderstanding; communications breakdown; message sent, not message received).	P I U H	P31 P66	2 3	5		(V)Communication (V)Accuracy
10. The student is able to identify causes of misunderstanding, including: inaccurate coding, inadequate coding, unmatched verbal and nonverbal cues (hidden or double message); inaccurate or inadequate decoding.	I U H	P48	2 5	5		(V)Communication (V)Discrimination (V)Insight
11. The student knows that the coding system must be known by sender and receiver if a message is to be accurately received.	I U H	G2 K7	3 4 5			(V)Communication (V)Accuracy

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.1 Identifying communication problems (Cont.)						
12. The student knows that decoding is complicated if sender is expressing but not identifying emotions.	I U H	G2 K7	3 4 5			(V)Communication (V)Accuracy
13. The student knows that messages may be inaccurately decoded if the receiver's expectations or feelings bias his or her perception (e.g., decoding one's own expectations or feelings, rather than message sent).	I U H	G2 K7	3 4 5			(V)Communication (V)Accuracy
14. The student knows that messages may be inadequately decoded if receiver is unable to clarify them through further communication (e.g., asking questions, paraphrasing).	I U H	G2 K7	3 4 5			(V)Communication (V)Accuracy
15. The student is able to determine the effects of roles, patterns, and norms on the accuracy and adequacy of communications (e.g., influence on intentions and expectations, consequent limitations on encoding, decoding).	I U H	P48	2 5			(C)Behavior (V)Communication (V)Insight
16. The student is able to identify real or simulated situations in which accuracy and adequacy of communications are limited by roles, patterns, or norms (e.g., classroom situations, peer group interactions, reporting situations.	I U H	P45	2 5			(C)Behavior (V)Communication (V)Discrimination

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.2 Using communication skills						
1. The student is able to acquire and use basic interpersonal communication skills (e.g., paraphrasing, describing behavior or feelings, checking perception).	P I U H	P65 P72 P74	2	5		(V)Communication (V)Mastery (V)Utility (V)Personal interaction (V)Growth and development
2. The student is able to paraphrase a message received (i.e., repeat in his own words what was heard to test comprehension; restate message as necessary until sender confirms accuracy).	P I U H	P44 P74	2	5		(V)Communication
3. The student is able to help the receiver of his or her message to clarify or refine a paraphrase.	P I U H	P65 P74	2 5	5		(V)Communication (V)Helpfulness
4. The student is able to recognize an accurate restatement of his or her intended message.	P I U H	P45	2 5	5		(V)Communication (V)Discrimination
5. The student is able to describe another person's behavior, telling what was observed rather than what was inferred (e.g., "crying" rather than "acting sad"; "yelling" rather than "losing his temper").	P I U H	P74	2	5		(C)Behavior (V)Communication
6. The student is able to distinguish between descriptions and interpretations of behavior.	P I U H	P45	2			(V)Communication (V)Discrimination

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.2 Using communication skills (Cont.)						
7. The student is able to describe his or her own feelings.	P I U H	P74	2	5	2.1.1.1	(V)Communication (V)Self-knowledge
8. The student is able to distinguish between descriptions and expressions of feelings.	I U H	P45	2			(V)Communication (V)Discrimination
9. The student knows descriptions name the feeling you have and the behavior you are responding to separately.	I U H	K3	4			
10. The student knows that expressions indicate feelings but do not necessarily name them, leaving room for inaccurate decoding.	I U H	K3	4			
11. The student knows that expressions often take such forms as commands, loaded questions, accusations, name-calling, sarcasm, or judgments.	I U H	G2 K3	4			
12. The student is able to select and use appropriate forms for describing feelings including naming the feelings, using similies, naming the kind of action the feeling urges you to do (e.g., I'm scared; I feel like a man on a tightrope with no net; I feel like running for cover and calling for mommy).	I U H	P33 P74	2			(V)Communication (V)Resourcefulness (V)Utility (V)Ingenuity

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.2 Using communication skills (Cont.)						
13. The student is able to check his or her perception of another person's feelings or intentions.	P I U H	P74	2			(V)Communication (V)Perception (V)Understanding
14. The student is able to use descriptions and questions appropriately in checking perception of another's feelings or intentions.	P I U H	P74	2			(V)Communication (V)Perception (V)Understanding
15. The student is able to give and receive feedback in interpersonal communication.	U H	P74	2			(V)Communication (V)Personal interaction
16. The student knows uses of structured interpersonal feedback (e.g., determining effects of one's behavior on others; revealing unknown intentions or expectations; providing information on which to base plans for personal change).	U H	K1 K2	3 4			
17. The student is able to give feedback according to conversational guidelines (e.g., ready receiver; description, not interpretation; recent events; appropriate situation; new information about changeable characteristics; no demands, no overloading; helpfulness, sharing).	U H	P74	2 3			(V)Communication (V)Self-discipline (V)Sensitivity

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.2 Using communication skills (Cont.)						
18. The student is able to follow conventional guidelines for receiving feedback (e.g., state specific things you want feedback about; check what you have heard; share reactions to the feedback).	U H	P74	2 3			(V)Communication (V)Self-discipline (V)Personal interaction
19. The student is able to encode intentions into appropriate behavior (i.e., use gestures, tone of voice, actions which will match intentions, to avoid hidden messages and misunderstanding).	P I U H	P65 P72 P74	2	5		(V)Communication (V)Accuracy (V)Self-direction (V)Personal interaction
20. The student is able to match nonverbal cues (gestures, actions, etc.) with words used in message (i.e., avoid confusion from double messages).	P I U H	P65 P72 P74	2			(V)Communication (V)Accuracy (V)Self-direction (V)Personal interaction
21. The student is able to distinguish between freeing and binding responses (i.e., responses which encourage greater accuracy and openness vs. those which limit communications and behavior).	U H	P45	2			(V)Personal interaction (V)Openness (V)Discrimination
22. The student is able to use freeing responses in appropriate situations.	U H	P65	2	5		(V)Personal interaction (V)Self-direction (V)Openness

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information
2.1.7.2 Exchanging information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.2.2 Using communication skills (Cont.)						
23. The student is able to select and use appropriate resources to develop communication skills.	P I U H	P33 P65	2	5		(V)Communication (V)Self-direction (V)Growth and development (V)Resourcefulness
24. The student is able to use communication skills appropriately to facilitate group processes or expedite achievement of tasks by a group (e.g., committee, task force, research team).	P I U H	P65	2 5	5		(V)Communication (V)Efficiency
25. The student is able to participate effectively in activities designed to improve accuracy or openness of group processes. (See J. William Pfeiffer and John E. Jones, Handbook of Structured Experiences for Human Relations Training, Volumes I-III, Iowa City, Iowa, University Associates Press, 1971.)	P I U H	P65	2 5	5		(V)Communication (V)Growth and development
26. The student is able to participate effectively in group inquiries or problem solutions (e.g., contribute ideas, work cooperatively).	P I U H	P65	2 5	5		(V)Problem solving (V)Inquiry (V)Cooperation (V)Efficiency

2. Processes and science
2.1 Universal inquiry-problem solving processes
2.1.7 Communicating information

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.1.7.3 Using communication systems						
1. The student is able to make effective use of modern telecommunication systems (e.g., telephone, data communication systems, television).	P I U H	P65	2 3	5	1.4.2	(V)Communication (V)Resourcefulness (V)Utility
2. The student is able to make effective use of conventional systems for transmitting written or printed information (e.g., mail service, publication and distribution systems, storage and retrieval systems).	P I U H	P65	2 3	5		(V)Communication (V)Resourcefulness (V)Utility

2. Processes and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2 Conventional science processes						
1. The student knows that science is an activity of the human mind, by its very nature open-ended (i.e., scientific knowledge will never be complete).	U H	G1 K2	4		2.1.2	(C)History of science (C)Research (V)Inquiry (V)Knowledge
2. The student knows that the three basic elements of science are observations, postulates, and hypotheses.	U H	G1 K5	4			(C)Research (V)Inquiry
3. The student knows that although the three elements of science operate together in human thinking, formal scientific inquiry is reductionist (i.e., observation, postulate, and hypothesis are dealt with as separate stages or aspects on inquiry).	U H	G1 K7	4			(C)Research (V)Inquiry (V)Intellect
4. The student knows that formal scientific inquiry begins with recorded observation.	U H	G2 K4	3 4		2.1.1	(C)Data representation (C)Research (V)Inquiry
5. The student knows that sense perceptions do not carry their interpretations with them, and in order to become the subject matter of science they must be recorded.	U H	G2 K3 K7	4			(C)Perception (V)Inquiry
6. The student knows that there are two requisites for observations: a principle of selection and a frame of reference.	U H	G2 K9	3 4			(C)Frame of reference (V)Inquiry (V)Knowledge

2. Processes and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2 Conventional science processes (Cont.)						
7. The student knows that sense perceptions are collected according to some principle of selection, even if intuitive in order to make meaningful statements about that principle of selection.	U H	G1 K7	4			(C)Perception (V)Inquiry
8. The student knows that observations are recorded or documented by relating selective perceptions to a frame of reference (e.g., horizon in astronomy).	U H	G2 K2 K6	3 4		5.7	(C)Data representation (C)Frame of reference (V)Inquiry
9. The student knows that the two requisites for observations start to structure science as soon as it begins.	U H	G2 K8	4			(C)Research (V)Inquiry (V)Organization
10. The student knows that postulating means finding or guessing a principle which orders and unites observations.	U H	K2	3 4			(C)Research (V)Inquiry (V)Insight
11. The student knows that postulates enable us to examine phenomena in the light of differing principles, hence to have different understanding of the same appearances present in the mind at once.	U H	G2 K2 K8	3 4			(C)Research (V)Inquiry (V)Intellect (V)Flexibility (V)Insight

2. Processes and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2 Conventional science processes (Cont.)						
12. The student knows that different understandings of the same phenomena lead to an effort to find some higher principle or principles which will unite the different understandings.	U H	G2 K4	4			(C)Research (V)Inquiry (V)Rationality (V)Unity (V)Organization
13. The student knows that scientists seek to discover more universal principles which explain phenomena.	I U H	G1 K3	4	1		(C)History of science (C)Research (V)Inquiry (V)Knowledge
14. The student knows that hypotheses reconcile or coordinate observations with postulates (e.g., observation: the moon is eclipsed only when in opposition to the sun; postulate: light travels in straight lines; hypothesis: lunar eclipses are caused by the earth's shadow).	U H	G1 K2	3 4		2.1.5	(C)Research (V)Inquiry (V)Organization (V)Inter-relatedness
15. The student knows ways in which scientists validate or "prove" hypotheses.	U H	K2 K7	3 4		2.1.2 2.1.5	(C)Research (V)Inquiry (V)Knowledge
16. The student knows that scientific conventions (e.g., vocabulary, measurements, standard procedures) permit scientists to communicate meaningfully, hence to build on the knowledge of others.	P I U H	G2 K2 K8	3 4			(C)History of science (C)Research (V)Communication (V)Inquiry (V)Knowledge
17. The student is able to use appropriate scientific conventions for documenting, interpreting, and communicating personal perceptions.	P I U H	P65	3	5		(V)Inquiry (V)Utility (V)Resourcefulness (V)Perception

2. Processes and science

2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1 Measuring/quantifying						
1. The student is able to select and use appropriate units and instruments for measuring identifiable, scientifically defined properties.	P I U H	P33 P35 P45 P65	2 3			(C)Measurement
2. The student is able to use measurements for various scientific purposes, including: identification of quantities, refinement of observations, accurate comparisons, meaningful communication of information.	P I U H	P33 P35 P45 P65	2 3			(C)Measurement
3. The student knows reasons for standardization of measurements.	P I U H	K8	3 4			(C)Measurement (C)Standardization
4. The student knows ways in which units are defined and standardized.	I U H	K2 K7	4			(C)Measurement (C)Standardization
5. The student knows measurable properties identified and defined by science.	I U H	K2 K3	3 4		5.1	(C)Measurement
6. The student knows basic units and instruments standardized for scientific use.	P I U H	K2	3			(C)Measurement (C)Standardization
7. The student is able to use standard procedures for accurate measurements.	P I U H	P35 P65	2 3			(C)Measurement (V)Utility (V)Accuracy

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1 Measuring/quantifying (Cont.)						
8. The student is able to determine degrees of precision and accuracy needed for purpose of measurement.	I U H	P45	2 3			(C)Measurement (V)Accuracy (V)Discrimination
9. The student is able to select measurement instruments and procedures appropriate to purpose (e.g., property to be measured, degree of precision or accuracy needed).	P I U H	P33 P45	2 3			(C)Measurement (V)Utility (V)Resourcefulness
10. The student is able to use appropriate scientific notation for accurately recording measurements.	P I U H	P66	2 3		2.1.3	(C)Data representation (C)Measurement (V)Utility (V)Accuracy

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.1 Measuring length						
1. The student knows that length is a measurable property of space.	I U H	K1 K3	3		5.1.3	(C)Measurement
2. The student is able to identify position of a point, using three numbers (e.g., latitude, longitude, elevation).	I U H	P33	2 3		6.1.4.1	(C)Measurement (V)Utility (V)Accuracy
3. The student is able to measure distance (i.e., the difference between two positions) using one number.	P I U H	P35 P45	2 3			(V)Utility (V)Competence
4. The student knows that the basic unit of length is standardized as the wave length of light spectra lines given off by glowing krypton.	U H	K2	3			
5. The student is able to measure length in metric units.	P I U H	P35 P45	2 3			
6. The student knows that the meter is standardized as 1,650,763.73 wave length of the red-orange line emitted by krypton 86.	H	K2	3			
7. The student is able to select and use metric units of length appropriate to purpose.	P I U H	P33 P45 P65	2 3			(V)Utility (V)Accuracy (V)Discrimination

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.1 Measuring length (Cont.)						
8. The student knows units derived from the meter, including: deca = 10 times kilo = 1,000 times mega = 1,000,000 times centi = 1/100 milli = 1/1,000 micro = 1/1,000,000 also: hecto = 100 times giga = 10^9 times terra = 10^{12} times deci = 1/10 nano = 10^{-9} pico = 10^{-12} femto = 10^{-15} atto = 10^{-18}	I U H	K2	3			
9. The student is able to measure length in U. S. Customary units.	P I U H	P35 P45	2 3			(V)Utility (V)Competence
10. The student knows that the yard is defined as 0.9144 meters.	U H	K2	3			

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.1 Measuring length (Cont.)						
11. The student knows units derived from the yard, including: • The foot is 1/3 yard. • The inch is 1/12 of a foot (originally 3 barleycorns laid end to end or five barleycorns placed side by side). • The mile is 5,280 feet (statute mile). Still used are: • The rod is 5½ yards (e.g., distances on canoe portages in the Superior National Forest are given in rods). • The chain (surveyor's or Guenter's) is 66 feet (used by land surveyors). • The link is 1/100 chain (used by land surveyors). • The nautical mile is 1.151 statute mile (intended to be one minute of arc on a great circle).	P I U H	K2	3			
12. The student is able to use appropriate instruments or devices for measuring length (e.g., calibrated stick or tape, radio signal, surveyor's stadia).	P I U H	P35 P65	2 3			(V)Utility (V)Competence
13. The student is able to represent length measurements accurately (e.g., use proper symbols, terms).	P I U H	P66	2 3			(C)Data representation (V)Accuracy

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.2 Measuring area						
1. The student is able to measure areas of surfaces.	P I U H	P35 P45	2 3			(V)Utility (V)Competence
2. The student is able to calculate area from length unit measurements.	P I U H	P35	2 3			
3. The student knows that units of area are length units squared: square meters (m^2) square feet (ft^2) 1 acre = 10 square chains or $\frac{1}{640}$ mile^2.	P I U H	K2	3			(C)Measurement
4. The student is able to use appropriate instruments and procedures to measure area (e.g., planimeter, calculations from length measurements).	P I U H	P35 P65	2 3			
5. The student is able to represent area measurements accurately.	P I U H	P66	2 3			(C)Data representation (V)Accuracy

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.3 Measuring volume						
1. The student is able to measure volume (i.e., the extent of occupying space).	P I U H	P35 P45	2 3			(V)Utility (V)Competence
2. The student is able to calculate volumes of solids and gases from length measurements squared: cubic meters (m^3), cubic feet (ft^3), etc.	I U H	P35	2 3			(V)Utility (V)Competence
3. The student is able to measure solid volume by displacement of liquid.	I U H	P35	2 3			(V)Utility (V)Competence
4. The student is able to measure liquid volume by use of graduated containers.	P I U H	P35	2 3			(V)Utility (V)Competence
5. The student is able to measure liquid volume in metric units (i.e., the liter and its derivative units).	P I U H	P35	2 3			(V)Utility (V)Competence
6. The student knows that the liter = 1000.028 cubic centimeters, and is defined as one kilogram of water under standard condition of pressure (one atmosphere) and at the temperature at which its density is maximum (about 40° C).	U H	K2	3			
7. The student is able to measure liquid volume in U. S. Customary units.	P I U H	P35	2 3			(V)Utility (V)Competence

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.3 Measuring volume (Cont.)						
8. The student knows U. S. Customary units of fluid volume, including: 1 gallon defined as 231 cubic inches 1 quart = 1/4 gallon 1 pint = 1/2 quart = 1/8 gallon 1 cup = 1/2 pint = 1/16 gallon 1 tablespoon = 1/16 cup = 1 1/256 gallon 1 teaspoon = 1/3 tablespoon 1 fluid ounce = 1/16 pint = 1/128 gallon 1 dram = 1/8 fluid ounce = 1/1024 gallon	P I U H	K2	3			
9. The student is able to measure dry volume in British Imperial units (i.e., units based on British Imperial gallon, defined as volume occupied by 10 lbs. of water at 62°F; different from U. S. Customary fluid gallon.	U H	P35 P45	2 3			
10. The student is able to measure dry volume in U.S. Customary units.	I U H	P35 P45	2 3			(V)Utility (V)Competence

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.3 Measuring volume (Cont.)						
11. The student knows U. S. Customary units of dry volume, including: 1 gallon = 1.16364 U.S. fluid gallon 1 pint = 1.16364 U.S. liquid pint 1 quart = 2 pints 1 peck = 8 quarts 1 bushel = 4 pecks	I U H	K2	3			
12. The student is able to distinguish between dry and fluid measurements.	I U H	P45	2 3			(V)Utility (V)Accuracy (V)Discrimination

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.4 Measuring angles						
1. The student is able to measure angles.	P I U H	P35	2 3			(C)Measurement
2. The student knows that an angle is a property of space and rotation: the angle between two lines is the amount of rotation necessary to make the lines parallel.	I U H	K2	2 3		5.1	(C)Measurement
3. The student is able to use angular measurements to identify position (e.g., latitude - longitude for point on earth).	I U H	P35	2 3		5.2 6.1.4.1	(V)Utility (V)Competence
4. The student is able to use angular measurements to identify the difference between two positions.	I U H	P35	2 3		6.1.4.1	
5. The student knows that angular units are dimensionless, being in effect ratios of two lengths.	I U H	K2 K3	3			
6. The student is able to use angular units appropriate to purpose.	P I U H	P35 P45	2 3			(V)Utility (V)Discrimination
7. The student knows basic angular units: radian = ratio of length of circular arc degree = $\frac{1}{360}$ of a circle minute = $\frac{1}{360}$ of a degree second = $\frac{1}{60}$ of a minute mil = $\frac{1}{6400}$ of a circle	P I U H	K2	3			(C)Measurement

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H .	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.4 Measuring angles (Cont.)						
8. The student is able to select and use appropriate instruments and procedures for measuring angles (e.g., protractor, surveyor's transit, calculations from length measurements using tables of trigonometric functions).	I U H	P33 P35 P45 P65	2 3			(V)Utility (V)Resourcefulness (V)Discrimination

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.5 Measuring time						
1. The student is able to use standardized units to represent a point or instant in time, measured from some arbitrary instant (i.e., identify time of day).	P I U H	P66	2 3		2.1.1.1 5.1.4 6.1.5	(C)Measurement (C)Time (V)Utility (V)Competence
2. The student is able to measure intervals of time in standardized units.	P I U H	P35 P45	2 3			(C)Time (V)Utility (V)Competence
3. The student knows relationships between time measurements and other spatial measurements (particularly when precise measurements are being made over large distances and/or times).	U H	K8 K10	3 4		5.1.4	(C)Time (C)Measurement
4. The student is able to use common time units and terms, including second, minute, hour, day, week, fortnight, month, year.	P I U H	P41 P66	2 3			(V)Utility (V)Communication
5. The student is able to use common frames of reference for identifying time of day at some position on the earth (e.g., Standard Time, Daylight Savings Time, Greenwich Mean Time).	I U H	P44	2 3		5.7 6.1.5	(V)Utility (V)Competence (V)Perspective
6. The student is able to use precision time measurements appropriate to situations and purposes.	H	P35 P65	2 3			(V)Utility (V)Accuracy

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.5 Measuring time (Cont.)						
7. The student knows the temporary time standard used for precision measurements: 1 second = 9,192,631,700 + 20 electromagnetic vibrations of cesium atoms.	H	K2	3			
8. The student is able to select and use units, instruments, and procedures for measuring time with degree of precision necessary to purpose.	P I U H	P33 P35 P65	2 3	5	5.1.4 6.1.5	(V)Utility (V)Accuracy (V)Resourcefulness (V)Discrimination
9. The student knows functions and purposes of various time measurement devices (e.g., clocks; stopwatches; electronic times; radio station WWV--time markers transmitted on shortwave radio by National Bureau of Standards).	P I U H	K2 K7	3 4	1		(C)Time (C)Measurement (C)Tools (V)Accuracy (V)Communication
10. The student knows characteristics and limitations of various timepieces (e.g., swinging pendulum clocks, hairspring pendulum clocks, electric clocks).	P I U H	K3 K5	3 4			(C)Time (C)Tools

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.6 Measuring mass						
1. The student is able to measure mass (i.e., compare mass of unknown object with that of known object).	P I U H	P45	2 3		5.1.2	(V)Utility (V)Competence
2. The student knows that mass is a property of matter, defined as resistance to change in motion.	I U H	K2	3			
3. The student is able to recognize mass as a measurable property distinct from weight, substance, etc. (e.g., mass is experienced when we try to stop or turn objects such as rolling automobiles, heavy boat, grocery cart; not when lifting objects).	P I U H	P44 P45	2			(V)Discrimination
4. The student is able to measure mass in metric units (i.e., kilograms, grams).	P I U H	P35 P45	2 3			(V)Utility (V)Competence
5. The student knows that the basic unit of mass is the kilogram, standardized as the mass of a platinum-iridium cylinder located at the International Bureau of Weights and Measures, at Sevres, France.	U H	K2	3			

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.6 Measuring mass (Cont.)						
6. The student is able to use "English" mass units as appropriate, generally in engineering (i.e., pound mass = .45359237 kilogram; 1 slug = mass of object which is accelerated one foot per second by a force of one pound-force).	H	P35 P45 P66	2 3			(V)Utility (V)Resourcefulness (V)Discrimination
7. The student is able to select and use appropriate instruments and procedures to measure mass (i.e., balance scales--chemical, sliding bar, etc.).	I U H	P33 P65	2 3			(V)Utility (V)Resourcefulness (V)Discrimination

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.7 Measuring energy						
1. The student is able to select and use appropriate units to measure energy in various forms.	I U H	P33 P35 P45 P63	2 3		5.5 5.9 5.11 5.12 5.13.8 5.16.4	(C)Measurement (C)Energy (V)Utility (V)Resource-fulness (V)Discrimination
2. The student is able to recognize measurable forms of energy.	P I U H	P44 P45	2 3		5.5 5.9 5.11 5.12 5.13.8 5.16.4	(C)Erergy (V)Insight
3. The student knows forms of energy, including: kinetic, potential, work, nuclear, chemical, elastic, gravitational, electromagnetic, heat.	I U H	K5	3 4			(C)Energy
4. The student is able to measure energy in metric units.	I U H	P35 P45 P65	2 3			(V)Utility
5. The student knows metric units used to measure energy, including: joule = one newton-meter erg = one dyne-centimeter calorie = heat needed to raise 1 gram of water 1°C at 15°C; or 4.186 joules kilowatt-hour = 3,600,000 joules	I U H	K2	3			(C)Energy

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.7 Measuring energy (Cont.)						
6. The student is able to measure energy in English engineering units: foot-pound, BTU (British Thermal Unit) = heat required to raise one pound of water one degree Fahrenheit, from 63° to 64°.	U H	P33 P45 P65	2 3			(V)Utility
7. The student is able to select and use appropriate instruments and procedures to measure energy.	U H	P33 P35 P45 P65	2 3			(V)Utility (V)Resourcefulness
8. The student knows devices commonly used to measure energy (e.g., watt-hour, electric meter, Prony brake, calorimeter).	U H	K2	3			(C)Tools (C)Measurement (C)Energy
9. The student is able to compute energy from measurements of relevant parameters (e.g., force and distance, mass and velocity).	H	P35	2 3		5.2	(C)Measurement (C)Energy (V)Utility

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.8 Measuring power						
1. The student is able to measure time rates of doing work, using standardized units.	U H	P35 P45 P65	2 3		5.5.2	(C)Technology (C)Measurement (V)Utility
2. The student knows units used to measure power (time rate of doing work), including: 1 watt = one joule per second (metric unit) 1 horsepower = 550 ft. pound per second (engineering unit) 1 lumen = 0.001496 (light power unit)	U H	K2	3			(C)Measurement
3. The student is able to use appropriate devices to measure power.	U H	P35 P45 P65	2 3			(C)Technology (V)Utility (V)Discrimination
4. The student knows devices used to measure power (e.g., wattmeter or calculations for electrical power; dynamometer or Prony brake for horsepower, photoelectric devices for light power).	U H	K2	3			(C)Tools

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.9 Measuring charge						
1. The student is able to measure electromagnetic force in appropriate standardized units.	U H	P35 P45 P65	2 3		5.4.2 5.13 5.14	(C)Measurement (C)Electricity (V)Utility (V)Resource-fulness
2. The student knows the unit used to measure charge (positive or negative): coulomb = amount of charge that flows in one second past a point in a conductor that carries one ampere of current.	U H	K2	2 3			
3. The student knows that the fundamental unit of charge = 1.60201×10^{-19} coulombs; and is the charge on a single electron (negative) or positron (positive) or proton (positive), etc.	H	K2	2 3			
4. The student is able to use appropriate devices to measure charge.	U H	P35 P45 P65	2 3			(V)Utility (V)Resource-fulness
5. The student knows methods of calculating charge including: a. Measuring time a current flows and values of current in amperes, computing product; b. Determining mass of some metal deposited electrochemically by a current, calculating from known mass of the metal atoms.	H	K2	3		2.2.5	

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.10 Measuring electrical potential						
1. The student is able to measure electrical potential in standardized units.	U H	P35 P45 P65	2 3		5.13	(C)Electricity (V)Utility
2. The student knows that electrical potential is the work required to move a charge between two points.	U H	K2	3			(C)Electricity
3. The student is able to recognize electric potential as a measurable property (e.g., analogy to the pressure of water in a pipe).	U H	P44 P45	2 3			
4. The student knows unit used to measure electrical potential: one volt = one joule per coulomb.	U H	K2	3			
5. The student is able to use a voltmeter.	U H	P35 P65	2 3			(V)Utility (V)Resourcefulness

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.11 Measuring force						
1. The student is able to measure force in standardized units.	I U H	P35 P45 P65	2 3		5.4 5.13.3 5.14.3	(C)Measurement (C)Force (V)Utility
2. The student knows that force is a property of a system of two or more objects (i.e., the interaction that tends to change state of motion--or rest--of an object).	I U H	G1 K2	3 4			(C)Force
3. The student is able to recognize force as a measurable property (e.g., squeezing a spring or holding it squeezed, holding a balloon under water, lifting a heavy object--force of gravity).	P I U H	P44 P45	2 3			(C)Force (V)Discrimination
4. The student knows that units of force are defined in terms of the acceleration of an object of unit mass.	U H	K2	3			
5. The student is able to measure force in metric units.	I U H	P35 P45 P65	2 3			(V)Utility
6. The student knows metric units used to measure force: newton = force required to accelerate one kilogram one meter per second per second dyne = force required to accelerate one gram one centimeter per second per second; equals $\frac{1}{100,000}$ newtons.	I U H	K2	3			(C)Force

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.11 Measuring force (Cont.)						
7. The student is able to measure force in "English" (engineering) units.	I U H	P35 P45 P65	2 3			(V)Utility (V)Resourcefulness
8. The student knows English or engineering units of force: poundal = force required to accelerate one pound-mass one foot per second per second pound-force = the force caused by gravity on an object with one pound-mass at a place where the acceleration due to gravity (of a free falling object) is 32.174 ft. per second.	I U H	K2	3			
9. The student is able to measure force using a spring scale.	P I U H	P35 P45 P65	2 3			(V)Utility (V)Resourcefulness

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.12 Measuring weight						
1. The student is able to measure weight.	P I U H	P35 P45 P65	2 3		5.4	(C)Measurement (V)Utility
2. The student knows that weight is the force characteristic of an object due to gravity between the earth--or other close astronomical body--and the object.	I U H	K2	3		5.4 6.1.5	
3. The student is able to recognize weight as a measurable property, distinct from mass, volume, other forces, etc.	P I U H	P44 P45	2 3			(V)Discrimination
4. The student is able to weigh objects in U. S. Customary units: pound (force) ounce = 1/16 pound dram = 1/16 ounce grain = 1/7000 pound ton (short) = 2000 pounds ton (long) = 2240 pounds	P I U H	P35 P45 P65	2 3			(V)Utility (V)Resourcefulness
5. The student is able to weigh objects in Apothecary (Troy) units: pound (Apothecary) = 5760 grains ounce (Apothecary) = 1/12 pound (Apothecary) dram (Apothecary) = 60 grains scruple = 60 grains	I U H	P35 P45 P65	2 3			(V)Utility (V)Resourcefulness

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.13 Measuring temperature						
1. The student is able to measure temperatures.	P I U H	P35 P45 P65	2 3		4.6 5.9.2	(V)Utility
2. The student knows that temperature is a statistical property of an object or region composed of many particles, defined as the ability to cause heat energy to be transferred from one object or region to another.	U H	K2	3		5.9	(C)Energy
3. The student knows standards on which temperature measurements are currently based (i.e., practical standard based on expansion of hydrogen gas, absolute standard based on entropy).	U H	K2	3			(C)Measurement
4. The student is able to recognize temperature as a statistical property.	U H	P44 P45	2 3			(V)Discrimination
5. The student is able to measure temperature as position on a scale.	P I U H	P35 P45 P65	2 3			(V)Utility
6. The student is able to measure the difference between two temperatures.	P I U H	P35 P45	2 3			(V)Utility
7. The student is able to measure temperatures in metric or English (Celsius; Fahrenheit) units.	P I U H	P35 P45 P65	2 3			(V)Utility (V)Resource-fulness

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.13 Measuring temperature (Cont.)						
8. The student knows that the Celsius or Centigrade scale identifies 0° as the freezing/melting point of water and 100° as the boiling point, with equal intervals (degrees) between.	P I U H	K2	3			(C)Measurement
9. The student knows that the Fahrenheit scale identifies 32° as the freezing/melting point of water, and 212° as the boiling point, with equal intervals (degrees) between.	P I U H	K2	3			(C)Measurement
10. The student is able to use Rankine or Remeaur temperature units and scales when appropriate.	H	P35 P45 P6.	2 3			(V)Utility (V)Resourcefulness
11. The student knows bases of Rankine and Remeaur scales (Rankine: parallel to Celsius but 0° is absolute zero; Remeaur: parallel to Fahrenheit, but water freezes at 0° and boils at 180°).	H	K2	3			
12. The student knows instruments used to measure temperature (e.g., thermometers using mercury or alcohol in glass, bi-metallic strip thermometers, thermocoupes, thermistor, pyrometers--measure high temperatures by color of glowing objects).	I U H	K2	3			
13. The student is able to select and use appropriate instruments to measure temperatures.	P I U H	P33 P35 P45 P65	2 3			(V)Utility (V)Resourcefulness (V)Discrimination

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.14 Measuring information (see also 5.17 Information)						
1. The student is able to measure information in bits (binary digits).	I U H	P35 P45 P65	2 3			(C)Information
2. The student knows that information is a statistical property of systems, identical to the physics concept of entropy.	H	K2	3			(C)Information (C)Systems (C)Entropy
3. The student knows that the amount of information contained in a situation is equal to the amount of uncertainty to be reduced.	H	K2	3			(C)Information
4. The student knows that bits of information represent the number of either/or choices needed to pick one thing out of the number of equivalent things in a situation (when each choice cuts the range of alternatives by half).	H	K2	3			(C)Information
5. The student knows formulas defining information (H)(e.g., (H) = $\log_2 W$ where W is number of equivalent things to be picked from).	H	K2	3			
6. The student knows that a bit = an either/or choice which reduces remaining alternatives by half.	H	K2	3			

2. Processes and science
2.2 Conventional science processes
2.2.1 Measuring/quantifying

COURSE GOALS	Level F/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.1.14 Measuring information (Cont.)						
7. The student is able to count the number of choices, guesses, or questions needed to identify one thing out of a given group of equivalent things, when each choice reduces the alternatives by half (i.e., count bits of information contained in the group of objects).	I U H	P35 P45 P65	2 3			
8. The student is able to select and use appropriate symbols, formulas, logarithmic tables, and calculations to determine the information content of a situation, condition, configuration, group, etc.	H	P33 P35 P45 P65	2 3			(V)Utility (V)Resourcefulness (V)Discrimination
9. The student knows ways of measuring information capacities of complex systems (e.g., in electrical or communications systems by range of frequencies of signal which can be carried by system).	H	K2	3			(C)Systems (C)Communication

2. Processes and science

2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2 Using equipment						
1. The student knows ways in which developing technology has affected the course, subjects, and structure of scientific inquiry.	P I U H	K4 K8	4	3		(C)History of science (C)Tools (C)Technology (C)Research (V)Inquiry
2. The student knows the specialized measurement tools, laboratory hardware, and software, sense extenders, electronics, etc., used by various disciplines.	I U H	K2	3	3		(C)Tools (C)Technology (C)Research (V)Inquiry (V)Utility
3. The student knows reasons for extensive use of precision tools in scientific research.	P I U H	K8	4			(C)Measurement (C)Research (C)Tools
4. The student knows current developments in the technology of scientific research.	I U H	K2 K4	3 4	3		(C)Research (C)Technology
5. The student is able to locate and use equipment needed for adequate inquiry or problem solving.	P I U H	P33 P65	1 2 3 5	5		(V)Inquiry (V)Problem solving (V)Utility (V)Resourcefulness

2. Processes and science
2.2 Conventional science processes
2.2.2 Using equipment

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2.1 Sense extenders						
1. The student is able to use a diffraction grating to detect the composition (by wave length and intensity) of visible lignt.	U H	P16	2 3		5.11	(V)Utility (V)Perception
2. The student is able to use polarizing material for various purposes (e.g., to detect plane-polarized light and the direction of its plane of polarization; to detect position of the sun from only a small patch of blue sky; to detect stresses in certain materials).	U H	P16	2 3		5.11	(V)Utility (V)Perception
3. The student is able to use stereophotos to detect depth and shape of very large objects.	I U H	P16	2 3			(V)Utility (V)Perception
4. The student is able to make and view time-lapse movies to extend ability to integrate events that take place over relatively long times.	U H	P16 P67	2 3			(C)Time (V)Utility (V)Perception
5. The student is able to use microscopes and telescopes to extend the minimum angle which can be visually detected.	P I U H	P16	2 3		3.1.2 6.1.4.2	(V)Perception (V)Utility
6. The student is able to use stethoscopes to improve clarity of certain sounds.	P I U H	P16	2 3		5.12	(V)Perception (V)Utility (V)Clarity

2. Processes and science
2.2 Conventional science processes
2.2.2 Using equipment

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2.1 Sense extenders (Cont.)						
7. The student is able to use microphones and electronic amplifiers to extend sensitivity to low intensity sound.	I U H	P16	2 3		5.12	(V)Perception (V)Sensitivity
8. The student is able to use infrared color film to extend color perception to infrared light.	P I U H	P16	2 3		5.11.6	(C)Color (V)Perception (V)Utility
9. The student is able to use moire patterns to detect minute displacements and velocities.	U H	P16	2 3			(V)Perception (V)Utility
10. The student is able to use feedback and operant conditioning principles to improve perception, awareness.	U H	P16 P65	2 3		2.1.6.2	(V)Perception (V)Utility (V)Growth and development
11. The student knows the use of masers and light amplifiers to extend sensitivity to very weak radiation.	U H	K2	3 4		5.11	(C)Technology (V)Inquiry
12. The student knows the use of X-rays to detect structure of crystals.	U H	K2	3 4		4.2.3.1 5.11.3	(C)Technology (V)Inquiry
13. The student knows instruments used to detect very small amounts of chemical species; the spectrograph, neutron activitation, X-ray diffraction cameras, chromotography, electrophoresis.	U H	K2	3 4		5.9 5.15.2	(C)Technology (V)Inquiry

2. Processes and science
2.2 Conventional science processes
2.2.2 Using equipment

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2.1 Sense extenders (Cont.)						
14. The student is able to see the direction of polarization of plane polarized light with Haidinger's brushes.	H	P16 P45	2 3		5.11	(V)Perception
15. The student is able to select, locate, and use appropriate sense extenders for various purposes.	P I U H	P16 P33 P65	2 3			(V)Utility (V)Resource-fulness
16. The student is able to properly store and maintain sense extenders after use.	P I U H	P65	2 3			(V)Responsibleness (V)Organization (V)Efficiency

2. Processes and science
2.2 Conventional science processes
2.2.2 Using equipment

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2.2 Laboratory equipment						
1. The student knows general categories of laboratory equipment (e.g., precision instruments, hardware, software, chemicals, electronic devices).	U H	K5	3 4			
2. The student is able to select and use effectively lab equipment which is appropriate to the subject and purpose of an inquiry (e.g., chemical analysis, dating of artifacts).	I U H	P33 P65	2 3			(V)Inquiry (V)Utility (V)Resourcefulness (V)Discrimination
3. The student is able to properly store and maintain lab equipment.	I U H	P65	2 3			(V)Responsibleness (V)Organization
4. The student is able to observe safety precautions in use of lab equipment.	I U H	P65	2 3			(V)Safety
5. The student is able to follow conventional procedures for effective use of lab equipment (e.g., follow directions from lab manual, instructor, or text).	I U H	P65	2 3			(V)Inquiry (V)Self-discipline (V)Efficiency
6. The student is able to adapt or modify standard lab procedures as needed to maximize accuracy and adequacy of inquiry (e.g., overcome limitations of space, time, inadequate facilities).	I U H	P65	2 3 8 9			(V)Responsibleness (V)Creativity (V)Flexibility (V)Accuracy

2. Processes and science
2.2 Conventional science processes
2.2.2 Using equipment

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2.2 Laboratory equipment (Cont.)						
7. The student is able to devise personally new laboratory procedures as needed to maximize accuracy and adequacy of inquiry.	I U H	P67	2 3 8 9			(V)Inquiry (V)Creativity (V)Accuracy
8. The student is able to evaluate the effectiveness of modified or innovative laboratory procedures.	I U H	P24 P54	2			(V)Critical judgment (V)Responsibleness
9. The student is able to use common materials appropriately for laboratory experiments or demonstrations (e.g., kitchen or classroom equipment; household substances - sugar, salt, cornstarch).	P I U H	P53 P65	2			(V)Inquiry (V)Ingenuity (V)Resourcefulness
10. The student is able to use laboratory chemicals safely and effectively.	P I U H	P65	2 3			(V)Utility (V)Self-discipline (V)Safety (V)Efficiency
11. The student is able to properly store and maintain laboratory chemicals.	P I U H	P65	2 3			(V)Responsibleness (V)Safety (V)Efficiency (V)Organization
12. The student is able to label laboratory chemicals accurately and clearly.	P I U H	P31	2 3			(V)Accuracy (V)Clarity (V)Safety
13. The student is able to decode chemical labels accurately.	P I U H	P41	2 3		7.2	(V)Utility (V)Accuracy (V)Safety

2. Processes and science
2.2 Conventional science processes
2.2.2 Using equipment

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.2.3 Data processing equipment						
1. The student is able to perform standard operations on a slide rule.	U H	P35	2 3			(V)Utility (V)Competence (V)Resourcefulness
2. The student is able to write programs for a computer available to the student.	H	P66 P67	2 3			(V)Utility (V)Creativity
3. The student is able to retrieve computerized information.	H	P35	2 3			(V)Utility (V)Resourcefulness
4. The student is able to select and use appropriate electronic devices for translating information from one form to another (e.g., oscilloscope to translate audio to visual signal).	H	P33 P35	2 3			(V)Utility (V)Resourcefulness
5. The student is able to select and use appropriate instruments for communicating scientific information.	P I U H	P33 P65 P66	2 3		2.1.7	(V)Communication (V)Utility (V)Resourcefulness (V)Discrimination
6. The student is able to follow prescribed procedures for operating and maintaining data processing equipment (e.g., observe safety precautions, avoid mechanical difficulties).	H	P65	2 3			(V)Self-discipline (V)Responsibleness (V)Organization (V)Efficiency

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.3 Using scientific vocabulary						
1. The student knows reasons for standardization of scientific terms, symbols, and measurement units (e.g., communicability, efficiency, accuracy, clarity).	P I U H	K1 K8	1 3 4	1		(C)History of science (C)Standardization (V)Communication (V)Accuracy (V)Clarity (V)Efficiency
2. The student knows ways in which scientific terms are standardized (e.g., principles, procedures, responsible institutions).	P I U H	K1 K7	4	1		(C)Standardization (C)History of science (V)Respect for others (V)Knowledge
3. The student knows forms in which scientific terms may be defined (e.g., formula, equation or statement relating term to fixed standard).	I U H	K2	4			(C)Standardization (V)Clarity (V)Organization
4. The student knows reasons why definitions of scientific terms may be modified (e.g., change in fixed standard; new information).	I U H	K2 K8	4			(C)Standardization (C)History of science (V)Flexibility (V)Knowledge
5. The student knows current controversies or issues related to standardization or use of scientific terms (e.g., term "free energy").	I U H	K3	4		Appendix I	(C)Standardization (C)History of science (V)Knowledge (V)Complexity

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.3 Using scientific vocabulary (Cont.)						
6. The student is able to use accurate scientific names for organisms, objects, elements, etc.	I U H	P31 P41 P66	2 3	5	7.2	(V)Communication (V)Utility (V)Accuracy (V)Resourcefulness
7. The student is able to use accurate scientific notation.	I U H	P31 P41 P66	2 3		7.2	(C)Standardization (C)History of science (V)Flexibility (V)Knowledge
8. The student is able to use measurement terms and symbols accurately.	P I U H	P31 P41 P66	2 3	5		(C)Measurement (V)Communication (V)Utility (V)Resourcefulness (V)Accuracy
9. The student is able to use accurately the terms which identify major scientific concepts (e.g., energy, mass, entropy; property, system, interaction; structure, function).	I U H	P31 P41 P66	2 3		2.2.6	(V)Communication (V)Utility (V)Resourcefulness (V)Accuracy
10. The student is able to use accurately the terms which identify major scientific principles, laws, and theories (e.g., uniformitarianism; conservation of energy; evaluation, relativity).	I U H	P31 P41 P66	2 3		2.2.6	(C)Theory (C)Scientific law (V)Communication (V)Utility (V)Resourcefulness (V)Accuracy

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.3 Using scientific vocabulary (Cont.)						
11. The student is able to distinguish between technical (standard scientific) and non-technical meanings of scientific terms (e.g., energy, weight, system, function, information).	I U H	P45	2 3			(V)Discrimination (V)Clarity (V)Accuracy (V)Communication
12. The student is able to locate and use appropriate resources for clarifying meanings of scientific terms.	I U H	P41 P65	2 3 5		2.1.1.2 7.3.1	(V)Resourcefulness (V)Clarity

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.4 Using models						
1. The student is able to decode scientific information represented in models (e.g., graphic, 3-dimensional, or dynamic forms).	P I U H	P41	2 3	5	7.2	(C)Data interpretation (V)Knowledge
2. The student is able to distinguish between the various scientific uses of the term "model," based on the context in which it is used.	U H	P45	2 3			(V)Discrimination (V)Accuracy (V)Clarity
3. The student knows that mental models are frames of reference or cognitive schemes: the sets of definitions, principles and criteria by which we mentally organize information.	U H	K2	3 4			(C)Frame of reference (V)Intellect (V)Organization
4. The student knows that procedural models are sets of conventionalized principles, strategies, instruments, etc., used for inquiry or problem solving (e.g., systems analysis, conflict resolution).	U H	K2	3 4			(V)Inquiry (V)Organization
5. The student knows that models may be displays: graphics, objects, or dynamic representations of ideas about reality (e.g., chart, diagram, diorama, scale model, dramatization).	P I U H	K2	3 4			(C)Data representation (V)Organization (V)Perception
6. The student knows that theoretical models are interpretative schemes or constructs; sets of ideas which explain observations by identifying factors and hypothesizing relationships.	U H	K2	3 4			(C)Theory (V)Inquiry

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.4 Using models (Cont.)						
7. The student is able to alter or expand his or her own mental models to accommodate newly validated scientific information.	P I U H	P64 P67	2 3			(C)Frame of reference (C)World view (V)Intellect (V)Openness
8. The student is able to select and follow procedural models which are appropriate purposes of inquiries.	H	P33 P65	2 3			(V)Inquiry (V)Self-direction (V)Discrimination
9. The student is able to construct models that aid in visualizing objects and phenomena (e.g., pipe cleaner genetic models, molecular models, crystal models, flow charts, stereoscopic models through stereophotos).	I U H	P67	2 3			(V)Creativity (V)Resourcefulness (V)Perception
10. The student is able to determine limitations of a model as representation of reality.	I U H	P24	2 3			(V)Critical judgment (V)Accuracy
11. The student is able to determine the scale of a model.	P I U H	P35 P41	2 3			(V)Utility (V)Accuracy
12. The student is able to construct a model to an appropriate scale.	P I U H	P66 P67	2 3			(V)Ingenuity (V)Organization
13. The student is able to identify the properties of reality that determine the substance, construction and organization of a theoretical construct.	H	P42 P44	2 3		2.2.6	(C)Theory (V)Insight
14. The student is able to identify the assumptions behind a theoretical construct.	H	P42 P48	2 3		2.2.6	(C)Theory (V)Rationality (V)Insight

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.4 Using models (Cont.)						
15. The student is able to distinguish between theoretical construct and the reality or observations the theory attempts to explain.	P I U H	P45	2 3		2.2.6	(C)Theory (V)Accuracy (V)Rationality
16. The student knows the role of observation in theory construction.	P I U H	K2	3 4		2.2.6	(C)Theory (V)Inquiry
17. The student knows relationships between scientific law and scientific theory.	I U H	K8 K10	3 4		2.2.6	(C)Theory (V)Scientific law (V)Knowledge
18. The student is able to evaluate theory against reality.	U H	P24 P53	2 3		2.1.2.4	(C)Theory (V)Inquiry (V)Critical judgment
19. The student is able to shape theory according to experiment.	H	P51	2 3		2.1.5.1	(C)Theory (V)Inquiry (V)Creativity (V)Accuracy

2. Processes and science
2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.5 Using mathematics (including statistics)						
1. The student is able to accurately associate mathematical representation--numerical or algebraic--with characteristics or properties of objects or systems.	I U H	P44	2 3	5		(C)Symbo[illegible] (V)Knowl[illegible] (V)Accu[illegible]
2. The student is able to determine the dimensionality of an object--or of properties or characteristics of objects.	I U H	P45	2 3			(V)Accur[illegible]
3. The student is able to distinguish between multi-componented measure--such as vectors--and single componented measure.	U H	P45	2 3			(V)Discrimination (V)Accuracy
4. The student is able to distinguish between continuous variation and discrete variation.	H	P45	2 3			(V)Discrimination (V)Accuracy
5. The student is able to manipulate mathematical representations to obtain useful information (e.g., to obtain the volume of a sphere from its diameter, or to solve algebraically for unknown quantities).	P I U H	P35	2 3			(V)Utility (V)Resourcefulness
6. The student is able to determine limits of accuracy of numerical data taken and of new data derived through mathematical manipulation.	U H	P24	2 3			(C)Data representation (C)Measurement (V)Accuracy

2. Processes and science

2.2 Conventional science processes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
2.2.5 Using mathematics (including statistics) (Cont.)						
7. The student is able to use dimensional analysis to indicate the appropriateness of representations or mathematical operations.	H	P22 P24 P43	2 3			(V)Utility (V)Resourcefulness (V)Critical judgment
8. The student is able to document observations statistically.	P I U H	P32 P35	2 3		2.1.5.1	(C)Data representation (V)Utility (V)Resourcefulness (V)Inquiry
9. The student is able to use appropriate conventional procedures for processing statistics.	I U H	P65	2 3			(C)Data interpretation (V)Utility (V)Resourcefulness (V)Inquiry
10. The student knows principles of statistical analysis.	H	G1 K2	2 3			(C)Data interpretation (V)Inquiry

3. Biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1 The cell						
1. The student knows the location and use of print and nonprint materials related to the cell (e.g., card catalog: "Cells," "DNA," "Embryology," "Protoplasm," "Protozoa"; SUBJECT GUIDE TO BOOKS IN PRINT: "Cells," "Cell-Motility," "Cells-Permeability," "Genetics," "Adaptation-Biology"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Cells," "Genes," "Plant Cells and Tissues"; READER'S GUIDE: "Cells," "Cells-Motility," "Differentiation-Biology"; LEARNING DIRECTORY: "Cell, Animal," "Cell Division," "Cell Material," "Cell Structure"; area and building audiovisual catalogs: "Cells," "DNA," "Embryology").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

3. Biology
3.1 The cell
3.1.1 Organisms are composed of cells

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.1.1 Basic building blocks						
1. The student knows that all living things are either composed of one or more cells, or (in the case of viruses, etc.), are dependent on cells for their continued existence.	P I U H	G2 K3	4			(C)Life
2. The student knows that cells are composed of elements (atoms) from the earth's atmosphere and crust.	I U H	K3 K10	4		4.1.2.1	(V)Life
3. The student knows that cells are arranged or organized to form the structures of organisms.	P I	K3	4			(C)Life
4. The student knows that cells are, by definition, the basic units of living structures.	I U H	K2	3 4			(C)Life

3. Biology
3.1 The cell
3.1.1 Organisms are composed of cells

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.1.2 Building an organism						
1. The student knows that some organisms have only one cell, and are called unicellular.	I U H	K1 K3	3 4			
2. The student knows that multicellular organisms are those composed of more than one cell.	I U H	K2 K3	3 4			
3. The student knows that in most multicellular organisms, cells are organized into tissues, organs, and systems.	P I U	K3	4			(C)Specialization
4. The student knows that in some multicellular organisms of the protist kingdom, cells are not organized into tissues or organs.	H	K3	4			
5. The student knows that multicellular organisms usually have cells specialized for certain functions.	P I U H	G2 K3	4			(C)Specialization
6. The student knows that a multicellular organism is composed of many types of interdependent cells.	P I U	K3	4			

3. Biology
3.1 The cell
3.1.2 Structure of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.2.1 General cell structure						
1. The student knows the parts of a generalized plant or animal cell (eucaryotic cell).	I U H	K2 K3	4			
2. The student knows the characteristics which differentiate living cells from nonliving matter.	I U H	K5	4			(C)Life
3. The student knows that plant and animal cells have many components in common.	I U H	K5	4			(C)Similarity
4. The student knows that historically, knowledge of cell structure has been acquired largely through the use of microscopes to extend human powers of observation.	P I	K7 K8	4			(C)Tools (C)Perception
5. The student knows that materials must be properly prepared (e.g.,cut, stained) before they may be seen through a microscope.	P I	K7	4			
6. The student is able to prepare materials so that they may be seen through a microscope.	I U H	P35	2 3		2.1.3 2.2.2.1	
7. The student knows the steps necessary to fix and stain plant and animal material on a slide.	I U H	K7	3 4		2.2.2.1	
8. The student is able to recognize a successful slide preparation.	I U H	P47	2 3		2.2.2.1	

3. Biology
3.1 The cell
3.1.2 Structure of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.2.1 General cell structure(Cont.)						
9. The student is able to discriminate between objects of biological origin and artifacts of slide preparation while looking through a microscope.	I U H	P16 P33	2 3		2.1.1 2.1.3 2.2.2.1	(C)Diversity
10. The student is able to recognize, from microscopic examination, the main parts of a cell (e.g.,nucleolus, vacuoles, plastids).	I U H	P16 P33	2 3		2.1.1 2.1.3	
11. The student knows the historic development of science's understanding of cell structure, including the major contributors, significant discoveries, methods of discovery, theories, and the short and long term effects of these discoveries on scientific and societal knowledge.	I U H	K4 K7 K8	1 4			(C)History of science (C)Theory (V)Respect for others
12. The student knows that some cells have no nucleus (e.g.,unicellular organisms of the monoran family).	H	K4	4		3.2.1.1	
13. The student knows modern instruments used to study molecular structure of cells (e.g., electron microscope).	I U H	K2 K7	3 4		2.2.2	(C)Tools
14. The student knows that the study of cells is called cytology.	U H	K1	3 4			

3. Biology
3.1 The cell
3.1.2 Structure of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.2.2 Relationship of structure to function						
1. The student knows that the term "function", as used in biology, refers to an action or process, but does not imply purpose.	I U	K2	3 4			
2. The student knows ways in which structure determines the function of cellular components (e.g., shapes and arrangements of molecules for bonding, other chemical reactions).	U H	K3 K8	4		4.1.3 4.1.4	(C)Specialization
3. The student knows that an organelle is a subcellular structure surrounded by a membrane and having a particular function.	U H	K2	3 4			
4. The student knows methods and instruments used to identify functions of cell parts.	I U H	K7	3 4			(C)Tools
5. The student knows major contributions from various sciences to the current biological knowledge of relationships between structure and function in cells.	I U H	K4 K8	4		4.1.2 4.1.3 4.1.4	(C)History of science (C)Similarities
6. The student knows that many recently discovered cell parts have currently unknown functions.	I U H	K3 K7	4			

3. Biology
3.1 The cell
3.1.2 Structure of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.2.2 Relationship of structure to function (Cont.)						
7. The student knows the functions of common cell parts.	P I U	K7	4			
8. The student knows the structure of the DNA molecule and the relationship of this structure to the reproduction of itself and to the production of protein.	U H	K3 K8	4		3.1.1.3 4.1.1	
9. The student is able to manipulate models of molecules (e.g., "Tinker Toys") which illustrate spatial relationships and their energy consequences.	I U H	P44 P76	2 3		2.2.4 3.1.1.3 4.1.4 5.8.1	

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.1 General cell function						
1. The student knows the meanings of terms used in biology to identify general cell functions (e.g., metabolism, reproduction, response).	I U	K2	3 4			
2. The student knows that the cell ages and becomes inefficient, incapable of continuing metabolism at a renewing rate.	P I U	K3 K4	4			(C)Aging
3. The student knows that cellular death occurs when the metabolic rate falls below subsistence level or is drastically altered (e.g., by viruses, chemical poisons, radiation).	P I U	K3 K4	4			(C)Death
4. The student knows that cells decompose after death.	P I U	K3 K4	4			(C)Death
5. The student knows that many cells reproduce themselves.	P I	G2 K7	4			(C)Reproduction
6. The student knows that the ability to reproduce is one criteria by which material is classified as living or nonliving.	P I U	G2 K5	4		3.2.3.1	(C)Reproduction (C)Life

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.2 Transport of cellular material						
1. The student knows the difference between total permeability, impermeability, and selective permeability (permeability being the ability to pass through).	U H	K5	3 4			(C)Diversity
2. The student knows current theories of membrane structure and function.	U H	K2	4			
3. The student knows the difference between diffusion and osmosis.	U H	K5	3 4			
4. The student knows the ways in which substances move through cell membranes (e.g., passive diffusion, active transport, ingestion, excretion).	U H	K7	4			
5. The student knows that changes in physical factors affect the rate of dissolution of solids in living systems.	U H	K8	4		4.3	
6. The student knows that differences in molecular properties affect the rate of dissolution of solids in living systems.	U H	K8	4		4.3	
7. The student knows that, based on experimental evidence, the rate of osmosis is affected by change of many factors (e.g., temperature, concentration of solute, membrane permeability, energy expended by the cell).	U H	K8	4		4.4	

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3 Cell metabolism						
1. The student knows the materials which cells require to maintain life.	P I U H	K7	4			(C)Life
2. The student knows that the energy which drives metabolism comes indirectly from the bond energy of food.	U H	K3 K8	4		4.4	
3. The student knows that the ATP-ADP cycle transfers the bond energy of food to the bond energy of cellular components.	U H	K4 K7	4		4.4	
4. The student knows that most life processes obtain their energy requirements directly from chemical modification of adenosine triphosphate (ATP).	U H	K7 K10	4			(C)Life
5. The student knows the chemical sequence of events in respiration.	H	K4	4			
6. The student knows the relationships among CO_2, O_2, H_2O, energy, and carbohydrates with respect to photosynthesis and respiration.	U H	K10	4			
7. The student is able to measure the amount of carbon dioxide produced by a living system.	U H	P35	2 3		2.2.1	

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3 Cell metabolism (Cont.)						
8. The student is able to calculate the rate of respiration of a cell (organism) from measurements of its rate of CO_2 evolution.	U H	P35	2 3		2.1.3 2.2.5	
9. The student knows that respiration is dependent upon mechanisms present only in living cells.	P I U H	K8	4			
10. The student knows that enzymes, amino acids, ribosomal (RNA) and ribosomes function as a system to synthesize cell protein on the endoplasmic reticulum.	U H	K7	4			
11. The student knows that enzymes are catalysts which enable rapid chemical change at low temperatures making life possible.	U H	K2 K7	3 4		4.4	(C)Life
12. The student knows that living things obtain from the environment the matter and energy they need for growth and activity.	P I U H	G2 K6	4		3.4.1 5.5.1	(C)Energy
13. The student knows that some forms of life are dependent on molecular oxygen.	P I U H	G2 K8	4		3.4.3	
14. The student knows that the capture of radiant energy by green plant cells is basic to the growth and maintenance of most living things.	P I U H	G2 K8	4		3.4.3 4.9.6	(C)Energy

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3 Cell metabolism (Cont.)						
15. The student knows that matter cycles in and energy flows through the environment by means of the photosynthesis-respiration processes.	I U H	G1 K4	4		3.4.3.2 5.5.5	(C)Energy
16. The student knows that living systems gain energy when organic molecules are chemically modified in certain ways.	U H	K8	4		4.1.1 5.8.1	(C)Energy systems
17. The student knows that living systems use energy to bond atoms or small molecules into larger molecules.	U H	K4 K7	4		4.1.3	(C)Energy systems
18. The student knows that the interdependence of living things and their environment is related to the transformation of matter chemically from one form to another.	I U H	K8 K10	4		3.4.3 4.1.3	(C)Life
19. The student is able to manipulate models of molecules (e.g., "Tinker Toys") which illustrate chemical reactions.	I U H	P44 P76	2 3		2.2.4 4.1.4	(C)Molecular theory

3. Biology
3.1 The cell
3.1.3 Function of the cell
3.1.3.3 Cell metabolism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3.1 Plants						
1. The student knows that photosynthesis is a chemical process by which cells use the energy of sunlight to produce oxygen and food materials.	P I	K1 K3	3 4		4.4 4.9.6 5.8.1	(C)Energy
2. The student knows that cells of green plants are photosynthetic (they carry on photosynthesis).	P I	K3	4			
3. The student knows the products of photosynthesis (e.g., sugars, carbohydrates, oxygen).	P I	K3	4			
4. The student knows that chlorophylls are compounds which account for the green color of plant leaves, algae, etc., and which absorb light energy for photosynthesis.	P I	K1 K3	3 4			
5. The student knows materials required for photosynthesis (e.g., water, CO_2, enzymes, chlorophyll).	P I U H	K9	4			
6. The student knows the sequence of chemical reactions involved in photosynthesis.	H	K4	4		4.4	

3. Biology
3.1 The cell
3.1.3 Function of the cell
3.1.3.3 Cell metabolism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3.1 Plants (Cont.)						
7. The student knows factors which affect the rate of photosynthesis (e.g., intensity of sunlight, amounts of carbon dioxide available, temperature).	U H	K8	4		4.4	
8. The student is able to test the effects of various factors on rates of photosynthesis.	U H	P53	2 3		2.1.5	
9. The student is able to interpret experimental data which show the effects of a factor on the rate of photosynthesis.	U H	P42 P48	2 3		2.1.4	
10. The student knows that photosynthesis is a respiratory process (a gas exchange) and a food process (e.g., manufacturing sugars).	P I U	G2 K7	3 4			
11. The student knows cell structures and enzymes involved in photosynthesis.	H	K3	4		4.4	
12. The student knows a definition of photosynthesis that includes the light and dark reactions.	H	K2	3 4			

3. Biology
3.1 The cell
3.1.3 Function of the cell
3.1.3.3 Cell metabolism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3.1 Plants (Cont.)						
13. The student knows questions about photosynthesis still being researched (e.g., how it first happened, how chlorophylls channel radiant energy into chemical reactions, how much of earth's oxygen is created by photosynthesis).	U H	K3	1 4	1		(C)History of science (V)Respect for others (V)Inquiry (V)The unknown
14. The student knows current theories and research related to photosynthesis.	H	K3	4			
15. The student knows that photosynthesis is a basic process upon which all higher forms of life depend.	P I U H	G2 K4	1 4			(C)Ecology (V)Interdependence (V)Nature

3. Biology
3.1 The cell
3.1.3 Function of the cell
3.1.3.3 Cell metabolism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.3.2 Animals						
1. The student knows materials required by animal cells for survival and growth (e.g., oxygen, water, food).	P I	G2 K3	4			
2. The student knows metabolic processes by which animal cells convert matter and energy for survival, growth, and reproduction.	P I U	G2 K7	4			
3. The student knows terms and symbols used to identify enzymes produced by animal cells in metabolic processes.	I U H	K2	3 4		7.2	
4. The student knows ways in which animal cells process oxygen.	I U H	K7	4			
5. The student knows similarities and differences between metabolic processes in plant and animal cells.	I U H	K5	4			(C)Diversity (C)Similarity

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.4 Cell responses						
1. The student knows that cells respond to changes in the environment in many, but predictable, ways.	P I	K3 K8	4			
2. The student knows that the ability of cells to respond to external stimuli is called irritability.	I U H	K1 K2	3 4		3.2.2.3	
3. The student knows that electro-chemical and physical phenomena stimulate cell responses.	I U H	K8	4			
4. The student is able to conduct experiments, which show the nature of cell responses.	I U H	P53	2 3 8 9		2.1.5	
5. The student knows that the major energy source for cell response is the adenosine triphosphate (ATP) molecule.	U H	K6	4			
6. The student knows that it is possible to control cell responses by controlling the appropriate electrochemical and physical stimuli.	I U H	K8	4			
7. The student is able to control stimuli in such a way as to affect cell responses in a predicted fashion	U H	P53	4		2.1.5	

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.5 Concept of the gene						
1. The student knows the names of the DNA bases and their companion bases.	H	K1	3 4		4.3.1.1	
2. The student is able to construct a model DNA molecule with a particular base sequence.	H	P76	2 3		2.2.4	
3. The student knows that the sequence of DNA bases provides the "bits of information" for controlling cell structure and function.	I U H	K8	4		5.17	(C)Information
4. The student is able to construct model DNA molecules and show how they produce particular amino acids.	H	P76	3 4		2.2.4	
5. The student knows how the DNA bases "pair" with both DNA and RNA bases.	I U H	K7	4			
6. The student is able to disrupt the sequence of bases in a model DNA molecule to show mutation.	I U H	P76	2 3		2.2.4	
7. The student knows that individuals are unique because each individual's DNA molecules are unique.	I U H	G2 K8	1 4			(C)Life (C)Diversity (V)Individuality

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.5 Concept of the gene (Cont.)						
8. The student knows that the "blueprint" of an organism is passed from cell to cell by duplication of DNA, followed by mitosis.	I U H	K4 K7	4		5.17	(C)Information
9. The student knows the differences between asexual and sexual reproduction.	I U H	K5	4			(C)Diversity
10. The student knows that sexual reproduction provides for recombination of genes.	I U H	G2 K7	4			
11. The student is able to use models to contrast mitosis and meiosis.	U H	P76	2 3		2.2.4	
12. The student knows that much of the DNA present in cells is contained in the chromosomes.	U H	K6	4			
13. The student knows that diversity of gene combinations preadapts populations to certain environmental stresses.	I U H	K8	4		3.3.3	(C)Adaptation (C)Diversity
14. The student knows that offspring look similar to their parents.	P	K5	4		3.3.3	(C)Family
15. The student is able to match young animals with the appropriate parent.	P	P47	2		2.1.4	

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.5 Concept of the gene (Cont.)						
16. The student knows that a living thing is a product of its heredity and environment.	P I	G2 K8	4			(C)Environment (C)Life
17. The student knows meanings of terms and symbols used in genetics (e.g., phenotype, genotype, disjunction, x, y, chromosome, gene, hybrid).	U H	K2	3 4		3.3.3	
18. The student knows principles, development, and applications of chromosome theory.	U H	G1 K4	1 4	1	3.2.3.1	(C)History of science (V)Inquiry (V)Respect for others
19. The student knows that mutation refers to a heritable change in the genes of an organism.	P I U	K2	3 4		3.3.3	(C)Adaptation
20. The student is able to design experiments involving test crosses which will reveal genotypes of parental organisms.	U H	P53	2 3 8		2.1.5	
21. The student is able to calculate F_1 and F_2 genotypes and phenotypes from parental genotypes for monohybrid, dihybrid, and trihybrid crosses.	H	P53	2 3		2.1.5	
22. The student knows the contributions of various scientists to the gene concept (e.g., Aristotle, Leeuwenhoek, Darwin, Mendel, DeVries, Lysenko, Lamarck, Watson, Crick, Bridges, Sutton, Morgan, Beadle, H. J. Juller).	I U H	K1 K4 K6	1 4	1		(C)History of science (V)Respect for others (V)Inquiry

3. Biology
3.1 The cell
3.1.3 Function of the cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.3.5 Concept of the gene (Cont.)						
23. The student knows that scientists are currently researching the possibilities of genetic engineering or genetic manipulation in various organisms.	I U H	K4 K7	4			(C)Life (C)Technology
24. The student knows moral, ethical, and legal issues involved in the possible uses of genetic engineering.	I U H	K9	1 4 5			(V)Respect for others (V)Respect for life (V)Social concern (V)Quality of life (V)Ingenuity
25. The student is able to analyze and clarify issues involved in the uses of genetic engineering.	I U H	P43 P63	1 4 5		1.1.3.2	(V)Problem-solving (V)Critical judgment

3. Biology
3.1 The cell

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.1.4 Specialized cells						
1. The student knows there are specialized cells (e.g., nerves, muscles, connective tissue).	P I	G2 K3	4			(C)Specialization
2. The student knows the structure and function of various kinds of specialized cells.	P I U H	K3 K7	4			(C)Specialization

3. Biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2 The organism						
1. The student knows the location and use of print and nonprint materials related to the organism (e.g., card catalog: "Physiology," "Botany-Anatomy," "Plant Physiology," "Embryology," "Reproduction"; SUBJECT GUIDE TO BOOKS IN PRINT: "Plant Physiology," "Plants-Reproduction"; see names of organs; READER'S GUIDE: "Tissues," "Plant Cells and Tissues," "Respiratory Organs," "Reproduction, Asexual"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Cells and Tissue," "Reproduction," "Fungi-Reproduction," "Roots"; LEARNING DIRECTORY: "Organism," "Organism, Living, Structure," "Organ, Vital," "Tissue, Animal," "Circulatory System," "Human Biology").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

3. Biology
3.2 The organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1 Structure of the organism						
1. The student knows that the word "organism" refers to an individual living thing.	P I	K2	3 4			(C)Life
2. The student knows that biological sciences concerned with the structure of organisms include anatomy and morphology.	I U H	K2	3 4			
3. The student knows that the term "anatomy" may refer to the structure of a particular organism, or to the scientific discipline which studies biological structures.	I U H	K2	3 4			
4. The student knows that the term "morphology" refers to the physical form of an object or region, or to the biological and physical sciences concerned with forms, shapes, and physical features.	U H	K2	3 4		6.3.2.3	
5. The student knows basic structural characteristics of organisms being studied (e.g., features, shapes and arrangements of component parts).	P I	K3	4			
6. The student knows that structures of organisms provide for covering, nutrition, gas exchange, support, locomotion, reproduction, growth, and information (sensing, reacting) of the organism in its natural habitat.	P I	K3 K10	4		3.4.1	

3. Biology
3.2 The organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1 Structure of the organism (Cont.)						
7. The student knows that there is diversity in structures of organisms.	P	K3 K5	4			(C)Diversity
8. The student knows that structural characteristics of organisms vary in shape (morphology), composition (kinds of tissues, cells), color, size, location in the organism, etc.	P I	K3 K5 K6	4			(C)Diversity
9. The student knows external and internal structures characteristic of organisms in various aquatic habitats (e.g., ocean, shoreline, stream).	P I	K3	4		3.4.1	
10. The student knows external and internal structures characteristic of organisms in various land habitats (e.g., deserts, tropics, polar region, temperate zone).	P I	K3	4		3.2.3.3 3.4.1	
11. The student knows external and internal structures characteristic of organisms that move through the air.	P I	K3	4		3.2.3.3 3.4.1	
12. The student knows external and internal structures characteristic of organisms that live underground.	P I	K3	4		3.2.3.3 3.4.1	
13. The student knows external and internal structures characteristic of various microorganisms.	P I	K3	4		3.2.3.3	

3. Biology

3.2 The organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1 Structure of the organism (Cont.)						
14. The student is able to infer the natural habitat of an organism from its structural characteristics.	P I	P42	4		3.4.1	
15. The student knows that parts of organisms may have several functions (e.g., human skin covers, senses, respirates).	P I	K3 K7	4			
16. The student knows that some parts of organisms are specialized for a particular function (e.g., lungs for respiration).	P I	K3 K7	4		3.2.1.2	
17. The student knows external structures that provide survival advantage to various organisms (e.g., turtle shell, cactus spine).	P I	K3 K7	4		3.4	
18. The student knows ways in which external physical characteristics affect the survival of organisms (e.g., camouflage to elude predators, distinctive coloring to signal aggressiveness and identity to competitors).	P I	K3 K7	4		3.4.2	
19. The student knows structural changes characteristic of the various stage of an organism's growth.	P I	K3 K10	4		3.2.2.3	
20. The student knows common names for structural characteristics or parts of organisms being studied.	P I	K1	3 4			

3. Biology
3.2 The organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1 Structure of the organism (Cont.)						
21. The student knows scientific names for structural characteristics or parts of organisms.	I U H	K1	3 4		2.2.3 7.1.2	
22. The student is able to use accurately terms which identify structures of organisms or categories of structures.	P I U H	P31 P66 P74	2 3		2.2.3 7.1.2	
23. The student knows instruments and procedures used to identify organisms on the basis of their structures.	P I U H	K7	3 4		3.2.3.1	
24. The student is able to identify organisms from observations of their structures.	P I U H	P33 P45	2 3		3.2.3.1	
25. The student knows instruments and procedures used to examine and study structures of organisms (e.g., dissecting, observing under microscope).	I U H	K7	3 4		2.2.2	
26. The student is able to use conventional instruments and procedures to examine structures of organisms.	I U H	P53	2 3		2.2.2	
27. The student knows significant historical contributions to scientific knowledge of the structure of organisms, including contributors, their discoveries, methods and materials used, theories offered, and their scientific and societal impact.	P I U H	K2 K4	1 4	1		(C)Theory (C)History of science (V)Respect for others (V)Inquiry

3. Biology
3.2 The organism
3.2.1 Structure of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1 Organs and complex tissues						
1. The student knows biological definitions of "organ" and "complex tissue".	P I U	K2	3 4			
2. The student knows that organs and complex tissues are composed of cells and perform specialized functions in an organism.	P I U	K2 K7	3 4			
3. The student knows common names for plant and animal organs.	P I	K2	3 4			
4. The student is able to use scientific names of plant and animal organs.	U H	P31 P41	2 3		2.2.3 7.1.2	
5. The student knows the common and scientific names used to identify kinds of complex tissues.	U H	K2	3 4		2.2.3 7.1.2	
6. The student knows criteria by which organs and tissues are identified and classified.	U H	K9	3 4			
7. The student knows methods, instruments, and materials used for laboratory study of organs and tissues.	I U H	K7	3 4		2.2.2	
8. The student knows ways in which scientists may alter, graft, or transplant organs and tissues in various organisms.	I U H	K7	3 4			(C)Technology

3. Biology
3.2 The organism
3.2.1 Structure of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1 Organs and complex tissues (Cont.)						
9. The student knows factors influencing the success or failure of organ or tissue transplants in various organisms.	I U H	K8	4			
10. The student knows organs and tissues whose functions are most critical to the survival of complex organisms, and the consequences of their failure or degeneration in various organisms (e.g., heart, lung, roots, bark).	P I	K3 K8	4			
11. The student knows that most organs and tissues undergo structural changes as the organism develops and ages.	P I	K4	4		3.2.2.3	(C)Growth
12. The student knows structural characteristics of organs at different stages of an organism's development.	P I	K3	4		3.2.2.3	(C)Growth

3. Biology
3.2 The organ
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.1 Organs and complex tissues--plants						
1. The student knows names and structural characteristics of major categories of plant tissues.	I U H	K1 K3 K5	3 4			
2. The student knows names and structural characteristics of common plant organs (e.g., root, stem, leaf, seed, fruit, flower).	P I	K1 K3 K5	3 4			
3. The student is able to identify parts of common plants from observation or pictures.	P I	P31	2 3			
4. The student knows reproductive organs common to major groups of plants (e.g., conifers, flower-bearing plants).	I U	K5	3 4		3.2.2.3.1	
5. The student is able to group or classify seeds, flowers, fruits, or cones by structural similarities and differences.	P I	P33	2 3		2.1.3.3 3.2.3.1	
6. The student knows that some plant tissues and organs will grow into mature plants when cut and replanted.	P I	K3	3 4		3.2.2.3.1	
7. The student knows structural characteristics of reproductive plant tissues.	I U H	K3	3 4		3.2.2.3.1	

3. Biology
3.2 The organ
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.1 Organs and complex tissues--plants (Cont.)						
8. The student knows internal and external structures common to seeds.	P I	K3	3 4			
9. The student is able to identify the parts of a flower.	P I	P31 P44	2 3			
10. The student is able to use conventional instruments and techniques for laboratory observation of plant tissues (e.g., dissection, slide preparation, microscopic examination).	I U H	P16 P35 P53	2 3		2.2.2	
11. The student is able to identify or classify plant tissues from laboratory observation, illustrations, or descriptive data.	I U H	P31 P33	2 3		2.1.3.3	

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal						
1. The student knows common names of animal organs and tissues.	P I	K2	4			
2. The student is able to use scientific names for animal organs.	I U	P31 P41 P66	2 3		2.2.3 7.1.2	
3. The student knows names and structural characteristics of major categories of animal tissues (e.g., connective, muscle, nervous, epithelial).	I U	K2 K3	3 4			
4. The student knows names and structural characteristics of subcategories of tissues (e.g., striated and smooth, muscle tissue, bone, cartilage, dense fibrous, loose fibrous, and liquid connective tissue).	U H	K2 K3	4			
5. The student knows that positions of organs in or on an animal's body vary among species (e.g., mouth of starfish is on underside).	P	K6	4			
6. The student knows the relative positions of organs in various species of animals.	P I	K6	4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal (Cont.)						
7. The student knows that the structural characteristics of internal and external animal organs vary among species (e.g., number of chambers in heart; shape, color, etc., of mouth and eyes).	P I	K5	4		3.2.3	
8. The student knows relationships between the structure of mouth, tongue, teeth, etc., and the types and locations of food the animal lives on (e.g., sharp teeth for tearing meat, long tongue for catching insects).	P I	K7 K8	4		3.4.1	(C)Adaptation
9. The student is able to relate mouth structures to the functions for which they are suited (e.g., sucking, tearing, grinding, cracking seeds, catching insects).	P I	P44	2		3.2.2.1	
10. The student knows that mouth structures vary within species (i.e., birds' beaks vary with kind of food and feeding habits).	P I	K5	4		3.2.3	
11. The student knows organs and tissues which permit animal organisms to entrap, and preserve other organisms for food (e.g., organs in spiders, bees, humans).	P I	K3 K7	4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal (Cont.)						
12. The student knows digestive organ of various animal organisms.	P I	K3 K7	4		3.2.1.2	
13. The student knows structural characteristics of bone tissue.	I U	K3	4			
14. The student knows structural characteristics of external support tissues (e.g., shells).	I U	K3	4			
15. The student knows structural characteristics of respiratory organs and tissues in various animal organisms.	I U	K3	4		3.2.1.2	
16. The student knows structural differences in respiratory organs of animals adapted to various habitats (e.g., gills of fish, noses of land animals).	P I U	K3 K5	4		3.4.1	
17. The student knows that some aquatic animals have respiratory organs which take oxygen from the atmosphere, and others have organs which take dissolved oxygen from the water (e.g., porpoise, fish).	P I	K5 K7	4			
18. The student knows structural characteristics of reproductive organs in animals or categories of animals being studied.	P I U	K3 K5	4		3.2.2.3	(C)Reproduction

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal (Cont.)						
19. The student is able to use conventional scientific terms for reproductive organs and tissues of animals.	I U	P31 P41 P66	2 3		2.2.3 7.1.2	(C)Reproduction
20. The student knows that reproductive organs are adapted to the habitat in which an animal reproduces.	P I U	K3 K5	4			(C)Adaptation (C)Reproduction
21. The student knows reproductive organs characteristic of various animal groups (e.g., insects, fish, birds, amphibians, mammals).	I U	K3 K5	4		3.2.3.2	(C)Reproduction
22. The student knows structural similarities and differences between tissues that aid locomotion in various animals or categories of animals (e.g., claw, hoof, fin tissues, scales of fish, feathers of birds).	I U	K5	4			(C)Similarities
23. The student knows body parts that aid an animal's movement (e.g., legs, fins, wings, claws, tentacles).	P	K3 K7	4			(C)Mobility
24. The student knows that large hind feet and legs are characteristic of animals who jump and run.	P	K3	4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal (Cont.)						
25. The student knows that web-footed animals probably live at least part of their lives in water.	P	K3	4		3.4.1	
26. The student knows that mature insects have six legs and 0, 2, or 4 wings.	P	K3	4			
27. The student knows that structures of some insects provide several kinds of mobility (e.g., crawling, jumping, flying).	P	K3 K7	4			(C)Mobility
28. The student knows similarities and differences between the wing structures of various animals or groups of animals.	P I U	K5	4			(C)Similarities
29. The student knows similarities and differences between fin structures in various aquatic animals.	P I U	K5	4		3.4.1	(C)Similarities
30. The student is able to identify major parts of an animal's locomotive system, using conventional scientific names.	I U H	P31	2 3		2.2.3	
31. The student knows ways of collecting animal tracks (e.g., casting, track traps, printing).	P I	K7	3 4			
32. The student is able to produce positive and negative casts of animal tracks.	P I	P76	2 3			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal (Cont.)						
33. The student knows that some characteristics of animals may be inferred from their tracks (e.g., identity, movement, size).	P I	K3	3 4			
34. The student knows similarities and differences between sensory organs of animals adapted to various conditions (e.g., land, water, underground; nocturnal, diurnal activity).	P I U	K5	4		3.4.1	(C)Adaptation (C)Perception
35. The student knows common names for sensory organs and tissues of animals (e.g., eyes, ears, antennae).	P I	K2	3 4			
36. The student is able to use conventional scientific terms for sensory organs and tissues of animals.	I U H	P31 P41 P66	2 3		2.2.3 7.1.2	
37. The student knows that some animals have eyes similar to those of humans.	P	K3	4			
38. The student knows that different animals have different kinds of ears, and some have no visible ears.	P	K3	4			
39. The student is able to design simple tests related to sense perception in animal organisms.	P I	P53	2 3			(C)Perception

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.1 Organs and complex tissues

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.1.2 Organs and complex tissues--animal (Cont.)						
40. The student knows that sensory organs of some animals are able to detect information which humans cannot directly perceive (i.e., high frequency sounds, images in "darkness").	P I	G2 K3 K7	1 4			(C)Perception (V)Self-knowledge
41. The student knows the components and organization of various animal sense organs.	U H	K3	4			(C)Perception
42. The student knows that glands are organs which produce secretions (e.g., adrenalin, perspiration).	P I	K2	4			
43. The student knows the names and structure of common animal glands.	P I U	K2 K3	3 4			
44. The student knows names, structures, and locations of glands in animals being studied.	U H	K2 K3 K6	3 4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.2 Organ and tissue systems						
1. The student knows that in many-celled organisms, groups of cells and tissues are organized into organ systems which are specialized to perform the bodily functions.	P I U	K3	4			(C)Specialization
2. The student knows structural characteristics of major organ and tissue systems.	P I U H	K3	4			
3. The student knows common and scientific names used to identify major organ and tissue systems.	P I U H	K2	3 4		2.2.3 7.1.2	
4. The student knows that major systems may be classified by function (e.g., digestive, respiratory, circulatory, regulative, locomotive, sensory, reproductive, supportive).	I U	K5	3 4			
5. The student knows that major systems may be classified by structural composition (e.g., skeleton, nervous system, muscular system, glandular system).	I U	K5	3 4			
6. The student knows structural similarities and differences between circulatory systems in plants and animals.	I U H	K5	4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.2 Organ and tissue systems (Cont.)						
7. The student knows structural similarities and differences between chemicals (e.g., hormones, enzymes, amino acids, sugars) manufactured in plant and animal systems.	U H	K5	4			
8. The student knows that males and females differ in external structures, internal structures, chemical makeup, and (in many cases) behavior patterns.	I U	K5	4			
9. The student knows that males and females of a species are distinguishable by observation of external organs, coloration, or behavior, and by dissection and analysis of internal organs and chemicals.	I U H	K5 K7	3 4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.2 Organ and tissue systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.2.1 Organ and tissue systems--plants						
1. The student knows the transport systems of plants (e.g., xylem, phloem).	U H	K1	3 4			
2. The student knows that there are tubes in plant stems which carry food and water.	P I	K7	4			
3. The student knows that the water in the soil is drawn up through roots and up through tubes in the plant stem to the leaves where some of the water evaporates.	P I	K7	4			
4. The student knows organ and tissue systems involved in photosynthesis.	I U	K7	4			
5. The student knows the structure of reproductive systems in various plants.	I U H	K3	4			
6. The student knows the structure of support systems in various plants.	I U H	K3	4			
7. The student knows structural differences of plant organ and tissue systems at various stages of growth.	I U H	K3 K5	4			(C)Growth

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.2 Organ and tissue systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.2.1 Organ and tissue systems--plants (Cont.)						
8. The student knows that the sensory systems of plants are subjects of current and controversial scientific research.	I U H	K7	4			
9. The student knows names and structural characteristics of substances manufactured in plant systems (e.g., chlorophyll, sap).	I U H	K1 K3	3 4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.2 Organ and tissue systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.2.2 Organ and tissue systems--animals						
1. The student knows the difference between whole blood and blood plasma on the basis of their constituents and their functions in transfusions.	U H	K5	4			
2. The student knows the difference between blood and lymph on the basis of their constituents and their function.	U H	K5	4			
3. The student is able to estimate an animal's size from the size of its skeletal system.	P I	P36	2 3			
4. The student knows major bone areas of skeletons (e.g., skull, rib cage, backbone, pelvis, femur, phalanges).	I U	K1	3 4			
5. The student knows the four kinds of joints and their functions (hinge joints, ball and socket joints, immovable joints, pivot joints).	I U	K3 K7	4			
6. The student knows that the study of bones and skeletal systems is called paleontology.	I U	K2	3 4			

3. Biology
3.2 The organism
3.2.1 Structure of the organism
3.2.1.2 Organ and tissue systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.1.2.2 Organ and tissue systems--animals (Cont.)						
7. The student knows methods and uses of paleontology.	U H	K7	3 4		6.3.4.3	
8. The student knows the structural organization of various animal sensory systems, and the ways in which the systems are adapted to the animal's habitat.	U H	K3 K8	4		3.4.1	(C)Perception (C)Adaptation
9. The student knows the structural changes of an organism during metamorphosis.	P I	K3 K4	4			
10. The student knows the structure of organ and tissue systems at various stages of metamorphosis.	U H	K3 K4	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.1 General function of parts of an organism						
1. The student knows materials needed by an organism for normal growth and survival.	P I	K7	4			(C)Growth (C)Life
2. The student knows the names of general functions or processes by which an organism acquires and uses the materials it needs for life.	P I U	K7	4			(C)Life
3. The student knows that functions or processes common to all organisms include internal transport of materials (circulation), conversion of materials and energy (metabolism), gas exchange (respiration), sensing and response (perception, regulation), origin, growth, reproduction, death (life cycle).	I U	K2 K7	4			(C)Life
4. The student knows functions carried out by various parts or systems in organisms.	I U H	K7	4		3.2.1.2	
5. The student knows conventional scientific methods, materials, and instruments used to study the functions of various organisms in a laboratory, or controlled situation.	P I U H	K7	3 4		2.1.5 2.2.2	

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.1 General function of parts of an organism (Cont.)						
6. The student is able to use conventional scientific methods, materials, and instruments to observe or experiment with functions of organisms at an appropriate level of complexity or sophistication.	P I U H	P11 P16 P53	2 3		2.1.5 2.2.2	
7. The student knows ways in which studies of animal or plant functions are used in medicine, psychology and other sciences concerned with human functions.	U H	K7	4 5			(C)Research
8. The student knows functional similarities and differences between various organisms and groups of organisms (mechanisms and processes of gas exchange in green plants, fish, insects).	I U H	K5 K7	4			(C)Diversity (C)Unity
9. The student knows ways in which functions of various systems interact to maintain life and growth (e.g., endocrine, nervous, digestive systems in animals).	U H	K7 K8 K10	4			(C)Life (C)Growth
10. The student knows that the functions of organisms are affected by many physiological and environmental factors.	I U H	G2 K8	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.1 General function of parts of an organism (Cont.)						
11. The student knows conventional methods, materials and instruments used to study the effects of physiological or environmental changes on the functions of organisms.	U H	K7	3 4		3.4.6 3.5.2	(C)Change
12. The student is able to plan and conduct experiments to determine the effects of physiological or environmental changes on the functions of various organisms, at an appropriate level of specificity or complexity.	P I U H	P53	1 2 3			(C)Experimentation (V)Inquiry (V)Problem solving
13. The student knows value issues or questions involved in scientific experimentation (interference) with the functions of living organisms.	P I U H	K9	1 3 4 5		Appendix I	(C)Experimentation (V)Respect for life
14. The student is able to analyze and clarify issues related to experimentation with functions of living organisms.	P I U H	P63 P64	1 2 3 5		1.1.3.2 2.1.6	(V)Respect for life (V)Critical judgment (V)Problem solving
15. The student knows the physiological factors which affect rates of circulation in organisms.	U H	K8	4			
16. The student knows that the factors affecting capillary circulation are the same as those affecting the rest of circulation.	I U H	K3 K8	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.2 Regulation in organisms						
1. The student knows that an organism may be seen as a complex system of interacting components and processes.	U H	G2 K6	4			(C)Systems
2. The student knows the meanings of the terms "systems", "regulation", "homeostasis", and "feedback".	U H	K2	3 4		2.1.5.2	(C)Systems
3. The student knows how regulation and homeostasis occur in organisms.	U H	K7	4			
4. The student knows that feedback systems are essential for regulation and homeostasis.	U H	K7	4			
5. The student knows that involuntary physiological responses act as regulators in the organism (e.g., allergic reaction, blink, tropisms, nastic movements).	U H	K7 K8	4			
6. The student knows physical factors in the environment to which an organism's regulatory systems respond.	I U H	K3 K8	4			(C)Perception (C)Behavior
7. The student knows organs, tissues, and chemicals which carry out regulatory functions in various organisms.	U H	K3 K7	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.2 Regulation in organisms (Cont.)						
8. The student is able to analyze mechanical, social, and living systems to compare the types of feedback which control each system.	U H	P43	2 3		2.1.5.2	(C)Systems
9. The student knows the consequences of failures or breakdowns of regulatory systems in organisms (e.g., illness, death).	U H	K8	4		2.1.5.2	(C)Systems
10. The student knows that regulation in systems is the subject of continuing scientific research in several disciplines.	U H	K2 K3	3 4		2.1.5.2	(C)Systems
11. The student knows similarities and differences between regulatory systems in various organisms (e.g., those with nervous systems and those without).	U H	K5	4			(C)Diversity (C)Unity
12. The student knows that many organisms undergo structural changes in response to seasonal changes of climate, as part of the organism's regulative functions (e.g., color change and falling of leaves, winter coats of animals).	P I U	K7	4		3.4.1	(C)Environment
13. The student knows the functions and characteristics of sleep and dormancy.	I U H	K3 K7	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.2 Regulation in organisms (Cont.)						
14. The student knows that there are observable changes in a plant in response to touch, heat, light, sound, air movements, and other external stimuli.	P I	K8	4		3.2.2.4	
15. The student knows that tropisms are plant responses toward or away from external stimuli (e.g., light, gravity, contact, water, chemicals).	H	K1 K2	3 4		3.2.2.4	
16. The student knows definitions of phototropism, geotropism, thigmotropism, hydrotropism, chemotropism.	H	K1 K2	3 4		3.2.2.4	
17. The student knows that nastic movements are plant responses in which movement is neither toward nor away from the stimulus (e.g., flower closing).	H	K1 K2	3 4			
18. The student is able to distinguish between tropic and nastic responses.	H	P45	2 3			
19. The student knows responses characteristic of simple organisms (e.g., protists, monorans), and the mechanisms involved.	H	K3	1 3 4		3.2.3.2	(V)Diversity (V)Unity (V)Nature (V)Insight

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3 Reproduction and development						
1. The student knows that reproduction refers to the production of offspring, or to the process by which new members of a species are produced.	P I	K2	3 4			(C)Reproduction
2. The student knows that the internal balance of chemicals in an organism varies during the egg producing cycle.	U H	K8	4			
3. The student knows the general sequence by which the gametes are developed during the process of meiosis.	I U H	K4	4			
4. The student knows that the union of gametes (fertilization) is usually necessary to restore normal gene complement and to produce viable offspring.	I U H	K7	4			
5. The student knows that growth in size or stage of development proceeds in an orderly sequence but not on a uniform time schedule for all species or individuals.	P I	K4	1 4	1		(C)Reproduction (C)Growth (V)Respect for others (V)Self-concept
6. The student knows the stages of embryonic development in selected organisms.	P I	K4	4		3.2.1.2	
7. The student knows approximate gestation periods normal for organisms being studied.	P I	K3	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3 Reproduction and development (Cont.)						
8. The student knows that certain conditions must be maintained for proper embryonic development.	P I	K6	4			(C)Reproduction (C)Growth (C)Environment
9. The student knows that the process of sexual maturation precipitates gross structural change in the developing organism.	I U	K4 K8	4 7		3.2.1.2	(C)Growth
10. The student knows each organism has its own process of growth and development.	P I	K3 K4	1 4 7	1		(C)Growth (C)Individual differences (V)Respect for others (V)Self-concept
11. The student knows that growth in a many-celled organism consists of multiplication, enlargement, and differentiation of cells.	I U H	K3	4			(C)Growth
12. The student knows that growth is continuous from infancy to adulthood, but various stages may be identified.	P I	K4	1 4	1		(C)Growth (V)Self-knowledge
13. The student knows that all organisms begin as one or more living cells of either one organism or of a heterosexual pair of like organisms.	P I	G2 K3 K4	4			(C)Reproduction (C)Growth (C)Life

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3 Reproduction and development (Cont.)						
14. The student knows definitions of birth, growth, death, survival, and adaptation.	P I	K2	3 4			(C)Life cycle
15. The student knows meanings of terms used to describe various kinds of reproduction, including asexual, sexual, bisexual, parthenogenesis, etc.	I U	K2	3 4			
16. The student knows that the union of sperm and egg (fertilization) produces a zygote.	P I	K7 K8	4			
17. The student knows a zygote may divide to form an embryo.	P I	K7 K8	4			
18. The student knows that an embryo is an organism in its initial stages of development.	P I	K2	3 4			
19. The student knows that fertilization is the union of sperm and egg cells which initiates the development of an embryo.	P I	K2	3 4			
20. The student knows that physical factors in the environment affect the development of embryos.	P I	K8	4		3.4.1	
21. The student knows that changes occur in living things during periods of time that are short enough to permit humans to observe and measure the changes.	I U H	K3 K7	4			(C)Change

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3 Reproduction and development (Cont.)						
22. The student knows reasons why biologists often select organisms with relatively short life cycles as subjects for research in genetics and reproduction.	I U H	K9	3 4			
23. The student knows that development refers to the passage of one stage in to the next, recognizable by the appearance of the structures, such as tendrils on pea plants.	I U	K2	3 4			(C)Development
24. The student knows that 'life cycle' is the sequence of changes as an organism develops from an egg to an adult, that in turn produces eggs or sperm which give rise to the next generation.	P I	K2 K7	1 3 4	1		(C)Life cycle (V)Life (V)Self-concept (V)Growth
25. The student knows that in most organisms which reproduce sexually, female fertility is periodic or cyclical.	I U	K3 K4	4			(C)Reproduction
26. The student knows relationships between periods of fertility and seasonal changes of climate in sexually reproductive organisms.	I U	K8 K10	4		3.4.1	(C)Reproduction

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.1 Reproduction and development--plants						
1. The student knows the names of the parts of a flower and the function of each part (e.g., stamen, pistil, petals, sepals).	P I	K1 K7	3 4			
2. The student knows that green plants have distinct reproductive systems and life cycle patterns.	P I	K3	4			
3. The student knows that most plants pass through two alternate generations: gametophyte and sporophyte.	I U H	K4	4			
4. The student knows reproductive parts, structure in which meiosis occurs, and sequence of the alternation of generations in algae, mosses, ferns, and flowering plants.	U H	K7	4			
5. The student knows that the gametophyte stage produces male and female gametes (sex cells) which combine to form a zygote (fertilized egg).	I U H	K7	4			
6. The student knows that the zygote produces the sporophyte stage which is asexual and produces a large number of spores which develop directly into a new gametophyte.	I U H	K7	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.1 Reproduction and development--plants (Cont.)						
7. The student knows the process of pollination and the special structures involved.	I U H	K7	4			
8. The student knows the processes by which sperm nuclei reach and fertilize the eggs of a plant.	I U H	K7	4			
9. The student knows that plant seeds can be found almost everywhere.	P	G2 K6	4			(C)Life
10. The student knows the names and functions of the parts of the seed (e.g., protective covering, endosperm, cotyledons, embryo).	I U H	K1 K7	3 4			
11. The student knows that the cotyledon is a leaf-like structure on the embryo of seed plants which stores food for the embryo's initial growth.	I U H	K2	3 4			
12. The student knows that seeds generally begin to germinate near the hilum.	I U H	K4 K6	4			
13. The student knows that the hilum of a seed is the scar where it was attached to the parent plant.	I U H	K2	3 4			
14. The student knows that many plants start from seeds.	P	G2 K4	4			

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.1 Reproduction and development--plants (Cont.)						
15. The student is able to test the effects of moisture, temperature, oxygen or light on seed germination and seedling growth.	P I U H	P53	2 3 8 9		2.1.5 2.2.2	
16. The student knows the steps in fruit development and maturation.	I U	K4	4			
17. The student is able to grow plants from seeds.	P I	P53	2 3 7			(C)Reproduction (V)Resourcefulness
18. The student knows methods, instruments, and materials used to observe and measure germination of seeds and growth of seedlings (e.g., lima beans in glass jar, ruler).	P I	K7	2 3 7		.2.2	
19. The student is able to observe, measure, and record seed or plant growth.	P I	P11 P32 P35	1 2 3			(V)Accuracy (V)Life
20. The student is able to grow plants from cuttings.	P I U	P53	1 2 3 7			(C)Reproduction (V)Resourcefulness
21. The student knows the sequence of structural changes involved in the reproductive cycle of higher plants: plant, bud, flower, fruit, seed, plant.	P I U	K4	4		3.3.2	(C)Life cycle

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.1 Reproduction and development--plants (Cont.)						
22. The student knows that seeds form in flowers.	P	K4	4			
23. The student knows ways in which pollen is carried to the ovary for pollination (e.g., wind, insects).	P I	K7	4			
24. The student knows the sequential order of stages in the life cycle of a common plant.	P I	K4	4			(C)Life cycle (C)Growth

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.2 Reproduction and development--animals						
1. The student knows that structures and functions of reproductive systems vary.	P I	G2 K5	4			(C)Diversity
2. The student knows that behavior patterns associated with reproduction vary among species.	P I	G2 K5	4		3.2.2.4	(C)Behavior
3. The student knows reproductive structures and functions characteristic of various major groups of animals (e.g., egg-laying animals, marsupials, mammals).	I U	K3 K5	4		3.3.2	(C)Diversity
4. The student knows ways in which animal reproduction differs from plant reproduction.	I U	K5	4		3.3.2	(C)Reproduction
5. The student knows that some animals lay clusters of eggs in protected places, some lay eggs and attend the eggs and offspring, and some give birth to offspring and care for them as they grow to maturity.	P	K3 K5	4			(C)Reproduction (C)Diversity
6. The student is able to correlate the parents and offspring of various animals.	P	P45	2			

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.2 Reproduction and development--animals (Cont.)						
7. The student knows that animals vary in degree of helplessness during early stages of life.	P	K4 K5	4			
8. The student knows that animals who give birth to their young find or make shelters in which to protect them from weather, predators, etc.	P	K3 K7	4		3.2.2.4	
9. The student knows that different species of animals make different kinds of homes for their young (e.g., nests, burrows, dens).	P	K5	4		3.2.2.4	
10. The student is able to correlate animal homes with their inhabitants (e.g., nest - bird).	P	P45	2			
11. The student knows that an embryo develops from a small part of the egg, and most of the egg serves as food for the growing embryo.	P	K3 K6	4			
12. The student knows layers which develop in selected animal embryos and the organ systems which develop from them.	I U H	K4 K6	1 4			(C)Life (V)Life (V)Unity (V)Diversity
13. The student is able to classify embryos or larvae from recognition of their patterns of development.	U H	P33	2 3		2.1.3 3.3.1	

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.2 Reproduction and development--animals (Cont.)						
14. The student knows chemical and major structural changes which occur in stages of reproductive cycles of selected animals.	U H	K4	4			
15. The student knows terms used to describe stages of development characteristic of various animals (e.g., embryo, fetus, baby, adult larva, pupa, maturity).	P I U	K2	3 4		7.1.2	(C)Life cycle
16. The student knows the environmental requirements for hatching eggs.	P I	K6	4		3.4.1	
17. The student knows the basic life cycle of reptiles.	P I	K4	4			(C)Life cycle
18. The student knows the basic life cycle of insects.	P I	K4	4			(C)Life cycle
19. The student knows the basic life cycle of amphibians.	P I	K4	4			(C)Life cycle
20. The student knows the basic life cycle of mammals.	P I	K4	4			(C)Life cycle
21. The student knows the basic life cycle of birds.	P I	K4	4			(C)Life cycle
22. The student knows the basic life cycle of fish.	P I	K4	4			(C)Life cycle

3. Biology
3.2 The organism
3.2.2 Function of the organism
3.2.2.3 Reproduction and development

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.3.2 Reproduction and development--animals (Cont.)						
23. The student is able to classify animal mothers into those which bear living offspring and those which lay eggs.	P	P33	2 3		3.3.1	
24. The student knows that many animals develop two sets of teeth (milk and permanent teeth).	P	K3 K4	4			
25. The student knows that metamorphosis is the change in body structure which occurs in the development of animals in which the body structure of the young is grossly different from that of the adult.	P I	K2 K4	3 4		3.2.1.2	
26. The student knows that larva is the first stage after hatching of any animal which undergoes metamorphosis (e.g., tadpole).	P I	K2 K4	3 4		3.2.1.2	
27. The student knows that pupa is the transition stage between larva and adult, of many insects which undergo metamorphosis.	P I	K2 K4	3 4		3.2.1.2	
28. The student knows that molt is the shedding of skin, feathers, hair, etc., by animals.	P I	K2	3 4			

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.4 Coordination and behavior						
1. The student knows that "behavior" refers to the manner in which organisms act or respond to stimuli.	P I	K2	3 4			(C)Behavior
2. The student knows that living things respond to change in the environment.	P	G2 K8	4		3.4 3.5	(C)Environment
3. The student knows conceptual differences between response and behavior (e.g., response may refer to automatic or involuntary reactions, behavior to complexes of voluntary and involuntary responses, actions, patterns of actions).	U H	K5	3 4		3.2.2.2	(C)Behavior (C)Regulation
4. The student knows that organisms have information systems: they receive information from their environment through perception (feedback or stimuli), process and react to the information (response, behavior).	H	K3	3 4		5.17	(C)Information (C)Systems
5. The student knows that patterns of behavior include regulatory or involuntary responses to the environment.	U H	K3	1 4			(C)Behavior (C)Regulation (V)Self-knowledge
6. The student knows ways in which various organisms perceive their environment (receive information).	P I U H	K7	1 4			(C)Perception (V)Life (V)Diversity (V)Unity (V)Self-concept

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.4 Coordination and behavior (Cont.)						
7. The student knows that behaviors of organisms may be categorized in various ways for various purposes (e.g., by function, by effect, by origin).	I U H	K5	3 4			(C)Behavior
8. The student knows that behaviors of organisms may be categorized as food-getting, escape/protective, reproductive, social, territorial, home range, homing, migratory, etc.	P I U	K2 K5	3 4			(C)Behavior
9. The student knows that behaviors of organisms may be categorized as learned or unlearned.	P I U	K2 K5	3 4			(C)Behavior
10. The student knows ways in which learned behavior is reinforced. (e.g., repetition, reward).	P I U	K7	4			(C)Behavior
11. The student is able to test a hypothesis related to learned behavior.	I U H	P53	1 2 3			(C)Behavior (V)Inquiry (V)Self-knowledge
12. The student knows current research and theories developed in the attempt to distinguish learned from unlearned behavior in various organisms.	I U H	K2 K3	1 3 4			(C)Behavior (V)Inquiry (V)Self-knowledge
13. The student knows that current data indicate that the higher the organism, the more of its behavior is learned, rather than unlearned (instinctive).	I U H	K10	1 4			(C)Behavior (V)Diversity (V)Self-knowledge

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.4 Coordination and behavior (Cont.)						
14. The student knows that behavior may be categorized as adaptive or accommodative.	I U H	K5	3 4			(C)Behavior
15. The student knows criteria by which behavior is classified as adaptive or accommodative.	I U H	K5 K9	3 4			(C)Behavior
16. The student is able to use conventional scientific terms to describe or classify behaviors of organisms.	I U H	P31 P33	2 3		2.2.3 7.1.2	(C)Behavior
17. The student knows scientific disciplines concerned with behavior, and the particular focus and methodologies of each (e.g., human and animal psychology, sociology, anthropology).	U H	K2 K3	3 4	1 3	8.2.5	
18. The student is able to observe and count specific behaviors for baseline data and documentation of changes, in a controlled observation or experiment.	P I U H	P11 P12 P32	1 2 3	4		(C)Behavior (V)Accuracy (V)Inquiry (V)Resourcefulness
19. The student is able to identify factors or variables affecting the behavior of organisms in a controlled observation or experimental situation.	I U H	P44 P52	1 2 3		2.1.5	(C)Behavior (V)Accuracy (V)Rationality (V)Discrimination (V)Self-knowledge

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.4 Coordination and behavior (Cont.)						
20. The student knows methods, materials, and instruments used to study behavior of organisms in a laboratory situation.	U H	K2 K7	3 4		2.1.5 2.2.2	(C)Behavior
21. The student knows methods, materials, and instruments used to study the behavior of organisms in their natural setting (field observation).	P I U H	K7	3 4			
22. The student is able to interpret graphs, charts, statistical tables, etc., displaying information about behavior of organisms.	P I U H	P41	1 2 3		2.1.4 7.2	(C)Data interpretation (V)Accuracy (V)Mastery (V)Inquiry
23. The student is able to represent behavioral data acquired through observation or experiment in appropriate graphic form (e.g., chart, table, graph, pictures).	P I U H	P66	1 2 3		1.3.3 2.1.6	(C)Data representation (V)Organization (V)Clarity (V)Communication (V)Accuracy
24. The student knows that procedures used in programs of behavior modification or behavioral management are based on principles derived from scientific research (e.g.,stimulus-response-reinforcement).	U H	K4	3 4		2.1.6	(C)Behavior

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.4 Coordination and behavior (Cont.)						
25. The student knows values in conflict over the morality, ethics, and effectiveness of behavioral management.	I U H	K9	1 4 7			(C)Behavior (C)Socialization (V)Freedom (V)Individuality (V)Education (V)Human rights (V)Social concern (V)Social stability
26. The student is able to analyze issues relating to specific or widespread use of behavioral management or behavior modification techniques in human society.	I U H	P43 P63	1 2 3 7			(C)Behavior (C)Socialization (V)Respect for others (V)Culture (V)Education (V)Problem solving (V)Critical judgment
27. The student knows that animal societies have patterns of social interaction.	P I U H	K3	1 4			(C)Behavior (C)Society (V)Diversity (V)Unity (V)Nature (V)Insight
28. The student knows ways in which animals communicate with each other.	I U H	K7	1 4			(C)Behavior (C)Communication (V)Diversity (V)Unity (V)Nature (V)Insight

3. Biology
3.2 The organism
3.2.2 Function of the organism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.2.4 Coordination and behavior (Cont.)						
29. The student knows current research related to social behavior of animals.	I U H	K2 K3	1 4			(C)Behavior (V)Diversity (V)Unity (V)Inquiry (V)Nature (V)Insight
30. The student knows current research related to communication and behavior in plants.	I U H	K2 K3	1 4			(C)Behavior (V)Diversity (V)Unity (V)Inquiry (V)Insight (V)Nature
31. The student knows that all organisms exhibit selectivity and variation in their responses and behavior.	U H	K3	4			(C)Behavior
32. The student knows that levels of behavior in various organisms may be identified as irritability (cell response), tropism (growth responses toward or away from stimuli), and taxis (movement of whole organism toward or away from stimulus).	H	K5	3 4			(C)Behavior
33. The student is able to classify organisms as exhibiting irritability, tropism, or taxis, working from observation, illustrations, or descriptive data.	H	P33	2 3		3.2.1.2 3.2.2.2	(C)Behavior

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.1 Classification systems						
1. The student knows that organisms may be grouped according to a variety of classification schemes.	P I	G2 K2	3 4		2.1.3.3	
2. The student knows that in all classification schemes, things are grouped together on the basis of common characteristics.	P I	G2 K2	3 4			
3. The student knows terms used to identify a set or subset in a classification scheme (e.g., group, category).	P I	G2 K2	3 4			
4. The student knows differences between one-stage, two-stage, and multi-stage classification systems.	P I	K5	3 4			
5. The student knows that a taxonomy of organisms is a multi-stage classification system.	I U	K3	3 4			
6. The student knows that in biological sciences, taxonomies of organisms are used to name and classify organisms according to their structural characteristics.	I U	K7	3 4			
7. The student knows that currently used taxonomic systems are derived from the Linnaean Taxonomy.	I U H	G2 K4	3 4			(C)History of science

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.1 Classification systems (Cont.)						
8. The student knows principles and characteristics of the Linnaean Taxonomy (e.g., classification by structure, use of Latin words).	I U H	K3 K9	3 4			(C)History of science
9. The student knows that the major categories in a taxonomy of organisms are called kingdoms, and are subdivided into phyla, classes, orders, families, genera, species, and varieties.	I U H	K1 K2	3 4			
10. The student knows that the original kingdoms in the Linnaean Taxonomy were plants (plantera) and animals (animalia).	I U H	K2	3 4			
11. The student knows that most biological taxonomies now include at least four kingdoms: plants, animals, protists, and monerans.	I U H	K2	3 4			
12. The student knows that taxonomies are changed as new organisms are discovered and as new information is acquired about known organisms.	I U H	G2 K8	3 4			
13. The student knows that studies in microbiology and other sciences are yielding discoveries of organisms which do not fit traditional categories.	I U H	K8	3 4			

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.1 Classification systems (Cont.)						
14. The student knows that biologists now classify organisms by genetic structure of their cells (cyto-taxonomy).	U H	K7	3 4			
15. The student knows methods, materials, and instruments used to classify or "type" organisms from laboratory analysis of genetic structures within cells.	H	K4	3 4	1		
16. The student knows major contributors to historic development of the science of taxonomy, and the context in which their work was done.	H	K	3 4	1		(C)History of science (V)Respect for others
17. The student knows meanings of terms "genotype" and "phenotype" as used in classifying organisms.	U H	K2	3 4		3.1.3.5 3.3.3	
18. The student knows that an organism's scientific name consists of two Latin words which identify its exact place in the taxonomy of organisms.	I U H	K1 K2	3 4		2.2.3 7.1.2	
19. The student knows that a taxonomic key is a reference containing scientific names and distinguishing characteristics of organisms, often accompanied by illustrations and common names (e.g., field guide, collector's index).	P I U	K2	3 4			

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.1 Classification systems (Cont.)						
20. The student knows situations in which taxonomic keys may be used (e.g., identifying unknown organisms, classifying organisms, labeling specimens correctly).	P I U	K7	3 4			
21. The student is able to use a taxonomic key to identify names of observed organisms or the taxonomic categories to which they belong.	P I U H	P31 P33 P41	2 3			
22. The student is able to classify organisms according to their conventional taxonomic categories from observations, illustrations, or descriptions.	U H	P31 P33	2 3		2.2.3	
23. The student knows that organisms may be grouped for study according to their size, habitat, use by humans, or other criteria.	P I	K5 K9	3 4		2.1.3.3	
24. The student knows that groups categorized by size, habitat, etc. may contain organisms from several taxonomic categories (e.g., microorganisms, aquatic organisms).	P I U	K3 K5	3 4			
25. The student knows that any one organism may be considered a member of various groups for various purposes (e.g., taxonomic group, habitat group, age group).	P I U	K5	3 4			

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.1 Classification systems (Cont.)						
26. The student is able to group organisms on the basis of observed similarities and differences in one characteristic (e.g., size, color, age, habitat).	P I	P33	2 3 8 9			(V)Discrimination (V)Organization
27. The student is able to construct a classification scheme, grouping organisms according to personally defined criteria.	U H	P33 P67	2 3 8 9		2.1.3.3	(V)Organization (V)Discrimination (V)Ingenuity
28. The student knows that areas of biological inquiry are classified and named according to the subject or special focus of the discipline (e.g., botany--study of plants; zoology--study of animals; cytology--study of cells; microbiology--study of microscopic organisms).	I U H	K2	3 4	3	8.2	

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.2 Taxonomic groups and characteristics						
1. The student knows characteristics distinguishing living from nonliving matter.	P I U H	K5 K9	1 4			(C)Life (V)Discrimination (V)Diversity (V)Insight
2. The student knows that viruses present taxonomic problems because they have characteristics of living and nonliving.	H	K3	1 3 4			(C)Life (V)Complexity (V)Nature
3. The student knows characteristics common to viruses.	U H	K3 K9	3 4			
4. The student knows characteristics which distinguish monorans.	U H	K3 K9	3 4			
5. The student knows characteristics which distinguish protists.	U H	K3 K9	3 4			
6. The student knows characteristics which distinguish plants.	P I U H	K3 K9	3 4			
7. The student knows characteristics which distinguish animals.	P I U H	K3 K9	3 4			
8. The student is able to correctly classify organisms as monoran, protist, plant or animal.	U H	P33	1 2 3			(V)Accuracy (V)Organization (V)Discrimination
9. The student knows characteristics which distinguish the various subkingdoms and phyla of major kingdoms of organisms.	U H	K3 K9	3 4			

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.2 Taxonomic groups and characteristics (Cont.)						
10. The student is able to identify structural characteristics which distinguish various classes, orders, families, genera, species, and varieties within a phylum (e.g., monocots, dicots).	U H	P33	3 4			
11. The student knows ways in which differences in functions or behaviors are related to structural differences in various taxonomic groups (e.g., kinds of responses exhibited by slime mold, flowering plant, mammal, as related to cell and tissue structures).	U H	K1C	1 4		3.1.2.2	(V)Inter-relatedness (V)Diversity (V)Unity (V)Nature
12. The student is able to classify organisms taxonomically from observation of selected parts, tissues, or cells.	I U	P33	1 3 4		2.2.1.1 3.1.4	(V)Discrimination (V)Resourcefulness (V)Inquiry
13. The student knows common names for taxonomic groups being studied (e.g., worms, insects, fish, birds, molds, bacteria).	P I	K1	1 3 4			(V)Communication (V)Clarity
14. The student is able to use scientific names for organisms being labeled, studied, reported on, etc.	U H	P31 P41 P66	1 2 3		2.2.3 7.1.2	(V)Accuracy (V)Clarity (V)Communication
15. The student is able to locate and use information about organisms which is organized taxonomically or alphabetically by scientific names.	H	P41	1 2 3		2.1.1 7.3	(C)Data retrieval (V)Inquiry (V)Resourcefulness

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.3 Other groupings and characteristics						
1. The student knows that microorganisms are organisms too small to see without special instruments.	P I	K1 K2	3 4			(C)Life
2. The student knows that microorganisms have characteristics which can be observed and recorded using modern instruments (microscopes, micrographs).	P I U	K2 K3	3 4			
3. The student is able to classify microorganisms from observed, illustrated, or described characteristics.	I U H	P33	2 3			
4. The student knows that microscopic life is almost everywhere on earth.	P I	K6	4			
5. The student knows that types of microorganisms are widely varied (they are not all members of one taxonomic kingdom or group).	P I	K3	4			
6. The student knows natural habitats of various microorganisms (e.g., water, air, soil, another organism).	P I U H	K6	4		3.4.1	(C)Environment
7. The student knows structures and functions of various microorganisms (e.g., cell structure, reproduction and growth, food-getting).	I U H	K3	4			

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.3 Other groupings and characteristics (Cont.)						
8. The student knows roles of microorganisms in ecosystems and communities.	I U H	K7	3 4		3.4.2 3.4.3	
9. The student knows roles of microorganisms in life processes of other organisms.	I U H	K7	3 4			
10. The student is able to classify microorganisms as parasitic, symbiotic, etc.	U H	P33	2 3			
11. The student knows ways of growing cultures of microorganisms.	P I U H	K7	3 4			
12. The student is able to grow cultures of microorganisms.	P I U H	P35	2 3			
13. The student knows methods, instruments, and materials used to study microscopic life.	I U H	K2 K7	3 4			(C)Tools (C)Research
14. The student is able to select and use appropriate instruments and methods to study microscopic life.	P I U H	P33	1 2 3			(V)Resourcefulness (V)Inquiry (V)Nature
15. The student is able to test a hypothesis about variables affecting functions or structures of microorganisms.	P I U H	P53	1 2 3		2.1.5.3	(V)Resourcefulness (V)Inquiry (V)Nature
16. The student is able to test a hypothesis about microorganisms as factors in living systems.	P I U H	P53	1 2 3		2.1.5.3	(V)Resourcefulness (V)Inquiry (V)Nature (V)Ecology

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.3 Other groupings and characteristics (Cont.)						
17. The student knows that prehistoric organisms are named and classified under the same taxonomic systems used for existing organisms.	I U	K1 K2	3 4		6.3.4	
18. The student knows examples of prehistoric organisms from various taxonomic categories and time periods.	P I	K3	3 4		6.3.4	
19. The student knows that functions and behaviors of prehistoric organisms are inferred from the remains of their structures, the location in which the remains are found, evidences of the habitat in which they lived, etc.	P I	K6 K7	4		6.3.4	(C)Research
20. The student knows common names for various prehistoric organisms.	P I	K1	4		6.3.4	
21. The student knows characteristics of various prehistoric organisms.	P I U H	K3	4		6.3.4	
22. The student is able to use scientific names of prehistoric organisms.	P I U H	P31 P66 P74	1 2 3		6.3.4	(V)Accuracy (V)Mastery (V)Communication
23. The student knows kinds of organisms which humans call food.	P I	K5	3 4		3.5	

3. Biology
3.2 The organism
3.2.3 Classification

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.3.3 Other groupings and characteristics (Cont.)						
24. The student knows kinds of organisms which humans call natural resources.	P I	K5	3 4		3.5	
25. The student knows kinds of organisms currently classed as "endangered species".	I U H	K5	1 3 4		3.5	(V)Nature (V)Social concern

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.1 Structure and function						
1. The student knows the functions of the tongue.	P I	K7	4		3.2.1.1	(C)Perception
2. The student knows the functions of the ear.	P I	K7	4		3.2.1.1	(C)Perception
3. The student knows how vibrations are conducted through the outer ear, the eardrum, the middle ear, and the inner ear of the human ear.	P I U	K4 K7	4		3.2.1.1	(C)Perception
4. The student knows the functions of the nose.	P I	K7	4		3.2.1.1	(C)Perception
5. The student knows the functions of the eyes.	P I	K7	4		3.2.1.1	(C)Perception
6. The student knows the function of the parts of the human eye.	P I U	K7	4		3.2.1.1	(C)Perception
7. The student knows that the heart pumps blood through tubes in the body.	P I	K7	4		3.2.1.2	
8. The student knows the predominant types of human muscle tissue and their functions.	I U H	K3 K7	4		3.2.1.2	
9. The student knows that the human skeletal system is used for support, locomotion, and protection.	P I	K7	4		3.2.1.2	
10. The student knows that opposing muscles work to cause movement of the body.	I U	K7	4		3.2.1.2	

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.1 Structure and function (Cont.)						
11. The student knows how the muscles and skeleton work together to produce locomotion.	P I U	K7	1 4		3.2.1.2	(V)Self-knowledge
12. The student knows the function of lungs, nose, nasal passage, and windpipe in the breathing process.	P I U	K7	4		3.2.1.2	
13. The student is able to relate the function of an organ to the function of the system in which it is found.	P I U	P44	2 3		3.2.1.2	
14. The student knows major parts of the digestive system, and the function of each part: mouth, teeth, tongue, food pipe, stomach, and intestine.	P I U	K3 K7	4		3.2.1.2	
15. The student knows the functions of salivary glands, mouth(s), general esophagus, sphincter muscle, stomach, gall bladder, liver, pancreas, large intestine, small intestine, appendix, and rectum.	I U H	K3 K7	4		3.2.1.2	
16. The student knows the function of the major parts of the central nervous system.	I U H	K3 K7	4		3.2.1.2	

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.1 Structure and function (Cont.)						
17. The student knows the parts and functions of the human circulatory system including the heart, arteries, veins, arterioles, and capillaries.	I U H	K3 K7	4		3.2.1.2	
18. The student knows the major endocrine structures in the human body and a function of each major structure.	I U H	K3 K7	4		3.2.1.2	
19. The student is able to infer the function of an organ or system from its structure and vice versa.	P I U	P42	2 3			
20. The student knows the functions of the skin.	I U H	K7	4		3.2.1.2	
21. The student knows the characteristics of different bones in the skeletal structure.	I U H	K3	4		3.2.1.1 3.2.1.2	
22. The student knows the ways in which different membranes relate to the function of bones.	I U H	K10	4		3.2.1.2	
23. The student knows the parts and functions of the reproductive systems of human males and females.	P I U H	K3	4		3.2.1.2	
24. The student knows ways in which human reproductive cycles differ from those of other mammals.	I U H	K5	4		3.2.2.3	

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.1 Structure and function (Cont.)						
25. The student knows contributions of scientific research to the regulation of control of human reproduction.	U H	K7	1 4	1		(C)History of science (V)Respect for others
26. The student knows value issues related to the regulation and control of human reproduction or human sexual behavior.	U H	K9	1 4	2	Appendix I	(C)Society (V)Problem solving (V)Social concern (V)Respect for others
27. The student knows similarities and differences between characteristic sexual behavior of humans and of other animals (e.g., relation to territoriality, periodicity, rituals).	U H	K5	1 4	1		(C)Society (C)Behavior (V)Inquiry (V)Insight (V)Self-knowledge
28. The student knows that human individuals have two parents.	P	G2 K3	4	2		(C)Life (C)Reproduction
29. The student knows meanings of terms used to identify processes or stages in the human reproductive cycle (e.g., ovulation, fertilization, conception, prenatal development gestation, labor, birth).	P I U	K2	1 3 4		3.2.2.3	(C)Reproduction (V)Self-knowledge (V)Life
30. The student knows the prenatal development of humans (e.g., formation of eggs and sperms, sex organs involved in transporting eggs and sperm, union of egg and sperm, sequence of development from zygote to embryo to fetus to birth).	I U H	K4	1 4		3.2.2.3	(V)Self-knowledge (V)Life

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.1 Structure and function (Cont.)						
31. The student knows the names and functions of various internal secretions (hormones, etc.) in human reproduction.	U H	K2 K7	3 4		3.2.2.3	
32. The student knows the effects of internal and introduced chemicals on human reproductive functions.	H	K8	1 4		3.2.2.3	(V)Self-knowledge (V)Responsibility

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.2 Human genetics						
1. The student knows that the principles of inheritance generally apply to human inheritance in the same way as to other organisms.	I U H	G2 K6	1 3 4		3.1.3.5 3.3.3	(C)Genetics (V)Insight (V)Self-knowledge
2. The student is able to analyze a family tree in terms of several genetic traits (e.g., hair color, ability to roll the tongue, handedness).	I U H	P43	2 3		3.1.3.5 3.3.3	
3. The student knows the functions of DNA, RNA, chromosomes, and genes in human organisms.	U H	K7	4		3.1.3.5	(C)Genetics
4. The student knows sciences concerned with human genetics, and the particular focus and methodologies of each (e.g., human anatomy, human physiology, medicine, information science, physical anthropology).	U H	K2 K7	3 4	3	3.1.3.5	(C)Genetics (C)History of science
5. The student knows the genetic definitions of dominance and recessiveness.	I U	K1 K2	3 4			
6. The student knows common structural characteristics of humans which are dominant and recessive (e.g., brown eyes dominant, blue eyes recessive; dark hair dominant, blond hair recessive).	I U	K5	4			

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.3 Human behavior						
1. The student is able to distinguish between voluntary and involuntary responses (e.g.,blowing nose vs. sneezing).	P I	P45	2		3.2.2.4	(C)Behavior
2. The student knows historic and current research and theories attempting to identify learned behavior or to distinguish learned from unlearned behaviors in humans.	I U H	K2 K5	1 4		3.2.2.4	(C)Behavior
3. The student knows sciences concerned with human behavior and the particular focus and methodologies of each (including psychology, sociology, anthropology, psychiatry, etc.).	I U H	K2 K7	4		3.2.2.4 8.2.5	(C)Behavior
4. The student knows relationships between an individual's knowledge; mental, social, and technical skills; values; and behavior.	U H	K8 K10	1 4 9			(C)Behavior (V)Self-knowledge
5. The student knows ways in which an individual's behavior is affected by information received in the brain from internal and external sensors.	P I U H	K8	1 4		3.2.2.2	(C)Information (C)Behavior (C)Perception (V)Self-knowledge
6. The student is able to use conventional scientific terms to identify, analyze, or communicate information about human behavior.	U H	P31 P43 P66	1 2 3		2.2.3 7.1.2	(C)Behavior (V)Communication (V)Clarity

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.3 Human behavior (Cont.)						
7. The student knows ways in which human behavior is affected by the introduction of various chemicals into the body (e.g., medicines, narcotics, vitamin supplements).	P I U H	K8	1 4	2	3.5.2	(C)Behavior (V)Self-knowledge
8. The student knows ways in which human behavior is affected by internal chemical changes.	I U H	K8	1 4	2		(C)Behavior (V)Self-knowledge
9. The student knows social, personal or academic issues related to regulation and control of human behavior.	I U H	K3	1 4	2	3.2.2.4 Appendix I	(C)Behavior (V)Social sensitivity (V)Problem solving

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.4 Health and hygiene						
1. The student knows an effective method of brushing his teeth.	P	K2	1 3 4	2		(V)Physical well-being
2. The student knows that improper care of teeth usually leads to tooth decay.	P	K8	4			
3. The student knows that dentists can often stop decay by grinding out the decaying part and prevent further decay by filling the resulting hole.	P	K8	4			
4. The student knows that the eyes of humans are protected by bones, eyelids, eyelashes, eyebrows, blinking, and tearing.	P	K3	4			
5. The student knows that our eyes may be injured by small or sharp objects striking them.	P	G2 K8	4			
6. The student is able to take proper care of his own skin (face and hands), teeth, hair, and nails.	P	P65	1 2	5		(V)Physical well-being (V)Responsibility
7. The student knows the meaning of the term physical fitness.	P	K2	3 4			
8. The student knows ways in which an individual's physical fitness affects his or her ability to function effectively in various situations, and to resist disease or degeneration of organs.	P I	K7 K8	1 4	3 4 5		(V)Physical well-being (V)Efficiency

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.4 Health and hygiene (Cont.)						
9. The student is able to recognize if a person has proper posture in standing, walking, and sitting.	P	P47	2			
10. The student knows four major food groups (meats, dairy products, fruits and vegetables, breads and cereals) and an individual's daily requirements for each.	P	K5	1 3 4	2		(V)Physical well-being
11. The student knows that nutrients (e.g., fats, carbohydrates, and proteins) are necessary to maintain good health.	P	K8	4			
12. The student knows why fruits and vegetables, dairy foods, breads and cereals, or meat, fish, and eggs are necessary for good health.	P I	K8	4			
13. The student knows ways in which minimum daily nutritional requirements are determined and standardized in the U.S.	I U	K2 K7	3 4			
14. The student knows standardized terms, symbols, and units used to identify and measure vitamins and minerals.	I U	K2	3 4		2.2.1	
15. The student knows that chemicals are often added to processed or packaged foods as preservatives, color or flavor enhancers, or nutritional additives.	P I U	G2 K7	4			(C)Technology

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.4 Health and hygiene (Cont.)						
16. The student is able to interpret information on package labels to determine whether the product contains chemical additives.	P I U H	P41 P45	1 2 3 5	2		(V)Discrimination
17. The student knows chemical substances which are poisonous or harmful to humans.	P I U H	K3	1 3 4			(V)Physical well-being
18. The student is able to interpret reports from government, medical, or scientific authorities which contain current data about short and long term effects of chemicals added to foods consumed by humans.	U H	P41	1 2 3 5		7.2	(C)Data interpretation (V)Critical judgment
19. The student is able to discriminate between nutritionally beneficial foods, foods which have low nutritional value, and foods which contain potentially harmful substances.	P I U H	P45	1 2 3 5			(V)Critical judgment
20. The student is able to use nutritional knowledge as a basis for making personal decisions about what to eat or serve to others.	P I U H	P62	1 5	2		(V)Physical well-being (V)Self-direction (V)Responsibility (V)Critical judgment
21. The student knows that oxygen is needed by man for survival.	P I	G2 K7 K9	4			(C)Survival
22. The student knows that cuts and injuries should be cared for immediately so they will heal quickly.	P	K8	1 4	2		

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.4 Health and hygiene (Cont.)						
23. The student knows that after exercise, a period of rest is needed for the body to maintain equilibrium.	P	K4	1 4	2		(C)Equilibrium
24. The student knows the importance of sleep to mental and physical health.	P	K4	1 4			
25. The student knows that there are effective methods used to prevent the spread of disease (e.g., immunization, isolation, personal cleanliness, environmental cleanliness).	P I	K7 K8	4			
26. The student knows that there are community agencies to which people may turn for help (e.g., fire department, police department, health department).	P I	K6 K7	1 4	1		(V)Resource-fulness
27. The student knows the ways in which public and private community agencies aid in the maintenance of health and hygiene.	P I U H	K7	1 4	1	8.2	(V)Respect for others (V)Community (V)Physical well-being
28. The student knows about the physiological and psychological effects of smoking, drinking, and drugs upon the human body.	I U H	K8	1 4	2		(V)Self-knowledge (V)Physical well-being
29. The student knows people and agencies providing help in emergency situations involving the health of an individual.	P	K6 K7	4	1		

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.4 Health and hygiene (Cont.)						
30. The student knows who to call and what to do in various kinds of emergency situations.	P I U H	K5	1 4	2		(V)Resourcefulness (V)Responsibleness (V)Physical well-being
31. The student knows the importance of regular physical examinations for good health.	P	K8	4	2		
32. The student knows the function of four general groups of disease-causing microorganisms: virus, fungus, bacteria, and protozoa.	U H	K7	4		3.2.3.2 3.2.3.3	
33. The student knows the three main types of bacteria: coccus, bacillus, spirillum.	U H	K1 K3	3 4		3.2.3.2	
34. The student knows the effect of the coordinated action of the respiratory, endocrine, digestive and circulatory system on food consumed by humans.	U H	K8	4		3.2.4.1	
35. The student knows the products resulting from the action of human systems on food in terms of growth, heat, energy, and excretory products.	U H	K8	4		3.2.4.1	
36. The student knows the contribution of scientists (e.g., Pasteur, Jenner, Lister, Salk, Fleming, Koch) toward the control of disease-producing agents.	P I U H	K1 K4 K7	1 4	1		(C)History of science (V)Respect for others (V)Inquiry

3. Biology
3.2 The organism
3.2.4 Human biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.2.4.4 Health and hygiene (Cont.)						
37. The student knows the relationships between humans and their parasites (e.g., ticks, mosquitoes, round worms, flukes).	I U H	K8	4		3.4.3	
38. The student knows that many sicknesses are caused by parasitic organisms.	I U H	K8	4			
39. The student knows that some substances manufactured for industrial or agricultural use have harmful effects on humans who inhale them (e.g., asbestos fibers, insecticides, enzyme detergent powders, adhesive sprays).	I U H	K8	4		3.5.3	(C)Pollution
40. The student knows that much scientific research is currently underway to determine short and long term side effects on humans of industrial and agricultural chemicals, food additives, radiation, and other products of scientific technology.	P I U H	G2 K7	1 4		3.5.3	(V)Physical well-being
41. The student knows current issues related to the identification, use, regulation, or control of manufactured products whose side effects may be harmful to human health.	P I U H	K7 K9	1 4 5 7	4	3.5.3	(V)Critical judgment (V)Physical well-being (V)Societal welfare
42. The student is able to clarify or analyze issues related to human health.	I U H	P45 P63	1 2 3 7	2	1.1.3.2	(V)Critical judgment (V)Responsibility (V)Problem solving

3. Biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3 Populations of organisms						
1. The student knows the location and use of print and nonprint materials related to populations of organisms (e.g., card catalog: "Growth (Plants)," "Plant Physiology," "Children--Growth," "Genetics," "Human Ecology," "Morality"; SUBJECT GUIDE TO BOOKS IN PRINT: "Growth," "Growth (Plants)," "Growth Promoting Substances," "Population Genetics"; READER'S GUIDE: "Growth (Plants)," "Mortality"; LEARNING DIRECTORY: "Growth, Human," "Growth Patterns," "Genetics, Population," "Balance, Nature").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

3. Biology
3.3 Populations of organisms
3.3.1 Dynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3.1.1 Growth						
1. The student knows that population refers to a group of organisms of the same species living and reproducing in a particular area.	P I U	K1 K2	3 4			(C)Population
2. The student knows that population growth means an increase in the size of population (greater number of individuals).	P I U	K2	3 4			(C)Population
3. The student knows factors which influence population growth.	P I U H	K8	4			(C)Growth
4. The student knows effects of uncontrolled population growth on the individuals in the population (e.g., stress, starvation).	I U H	K8	4			(C)Ecology (C)Population
5. The student knows effects of uncontrolled growth in one population on other related populations (e.g., food web disruptions).	I U H	K8	4		3.4.3.3 3.5.3	(C)Ecology
6. The student is able to measure growth and determine growth rate.	U H	P35	2 3		2.2.1	(C)Population (C)Growth
7. The student knows that growth rate can be predicted if one knows such things as migration rates, birth rates, etc.	I U	K7 K9	3 4			(C)Population

3. Biology
3.3 Populations of organisms
3.3.1 Dynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3.1.1 Growth (Cont.)						
8. The student is able to analyze problems of human population growth.	I U H	P43 P63	1 4	2 4	2.1.5.2	(C)Population (V)Problem solving (V)Social concern (V)Decision making
9. The student knows that demography is the study of human population growth, density, distribution, migration, and factors which affect them.	H	K2	3 4	3	8.2	(C)Population

3. Biology
3.3 Population of organisms
3.3.1 Dynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3.1.2 Mortality						
1. The student knows that organisms tend to die at a predictable rate under given sets of circumstances.	P I U H	K4	4			(C)Population
2. The student knows that mortality rates influence population growth rates.	P I U H	K8	4			(C)Population
3. The student knows factors which affect mortality rates of populations (e.g., climate, predator population, population stress, availability of food, interference of man, disease, catastrophe).	P I U H	K8	4		3.4.3 3.5.2	(C)Population
4. The student knows that there would be a vast increase in numbers of plants and animals if all offspring survived in each generation.	P I	K7	4			

3. Biology
3.3 Populations of organisms
3.3.2 Regulation

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3.2.1 Internal control						
1. The student knows there are normally many internal controls on population growth.	I U H	G2 K3	4			(C)Population
2. The student knows factors which function as internal controls on sizes of various populations.	I U H	K7	4		3.4.3	(C)Population
3. The student knows that certain stimuli (e.g., crowding) cause changes in an animal's physiology.	I U H	K8	4			(C)Ecology
4. The student knows that certain kinds of physiological changes lead to modification of animal behavior (e.g., increased aggression) which can lead to an increased population death rate.	I U H	K8	4		3.5.2	
5. The student knows that certain kinds of physiological change can decrease the rate of reproduction of an animal while others can increase it.	I U H	K8	4		3.5.2	(C)Population
6. The student knows current research and theories related to internal regulation and control in human and nonhuman populations (e.g., behavior of animals in overcrowded situations, physiological responses to stress).	I U H	K2 K3	1 3 4	4	8.2	(C)Population (V)Inquiry (V)Social concern (V)Self-knowledge

3. Biology
3.3 Populations of organisms
3.3.2 Regulation

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3.2.2 External control						
1. The student knows there are many external controls on population growth.	I U H	K8	4			(C)Population
2. The student knows factors which function as external controls on population growth.	I U H	K8	4			(C)Population
3. The student knows that many external factors can increase the rate of mortality (e.g., predation, competition).	P I	K8	4			
4. The student knows that many external factors can decrease the mortality rate (e.g., increased food supply, decreased predation).	P I	K8	4			
5. The student knows ways in which diseases are spread among animals.	I U H	K7 K8	4			
6. The student knows methods of animal control including use of pesticides, planting fish, drainage of water areas, etc.	P I	K7 K8	3 4		3.5.2	(C)Ecology
7. The student knows ways in which diseases are spread among plants.	I U H	K7 K8	4			
8. The student knows methods of plant control, including use of herbicides, fire, etc.	I U H	K7 K8	3 4		3.5.2	(C)Ecology
9. The student knows methods and materials used to control populations of microorganisms which are dangerous to humans, including vaccination, medication, etc.	I U H	K7 K8	3 4		3.2.4.4 3.5.2	

3. Biology

3.3 Population of organisms

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.3.3 Population genetics						
1. The student knows the meanings of terms conventionally used in the study of population genetics(e.g., gene pool, gene frequency).	I U H	K1 K2	3 4			
2. The student knows that some genes in the gene pool are different from their counterparts and that this can make it possible for the population to respond to stresses (changes) imposed on it in its environment.	U H	K5 K8	4			(C)Population
3. The student knows some effects of introducing new genes into a gene pool.	U H	K8	4			(C)Population
4. The student is able to apply the binomial expansion process to determine gene frequency in a stable population (Hardy-Weinberg Principle).	H	P35	2 3			
5. The student knows the genetic principles which apply to families apply to populations as well.	I U H	G2 K6	4		3.1.3.5 3.2.4.2	(C)Population
6. The student knows that over time, stable populations adapt genetically to their environments.	I U H	G2 K7	4		3.4.1	(C)Adaptation
7. The student knows that a genetic trait which has survival value in one environment may be disadvantageous in another environment (e.g., sickle cell anemia).	I U H	G2 K5	4			(C)Adaptation (C)Genetics
8. The student knows effects of mobility on gene pools of populations.	H	K8	4		3.5.2	(C)Population

3. Biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4 Natural systems						
1. The student knows the location and use of print and nonprint materials related to natural systems (e.g., card catalog: "Natural History," "Adaptation-Biology," "Anthropogeography," "Ecology," "Human Ecology"; SUBJECT GUIDE TO BOOKS IN PRINT: "Environment," "Biometry," "Evolution"; READER'S GUIDE: "Natural Selection," "Biome Projects," "Environment"; LEARNING DIRECTORY: "Biome, Land," "Biosphere," "Evolution," "Environment"; area and building audiovisual catalogs: "Natural Selection," "Adaptation-Biology," "Anthropogeography"; reference: McGraw-Hill Encyclopedia of Science and Technology).	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

3. Biology

3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.1 Natural environment (see also 6.3.5 Earth environments-environmental geology)						
1. The student knows that environment is the combination of all external factors which affect and influence growth, development, and reproduction of organisms.	P I	K2	3 4			(C)Environment
2. The student knows meanings of terms used conventionally in the study of natural environments, including habitat, climate, location, region, biome, factor, community, interactions, etc.	P I U	K2	3 4		2.2.3	(C)Environment
3. The student knows that environments may be studied from many viewpoints, including: analysis of energy and nutrient transfer systems (cycles, eco-systems); analysis of distribution of plants, animals, and nonliving materials in a region; analysis of life support systems; and analysis of historic and current relationships between plants, animals, and humans.	U H	G2 K7	1 3 4			(C)Environment (V)Inquiry (V)Perspective
4. The student knows scientific disciplines historically and currently concerned with the study of natural environment (e.g., biology, ecology, natural history, biogeography, environmental geology).	U H	K4 K7	1 3 4	1		(C)Environment (V)History of science (V)Respect for others (V)Inquiry

3. Biology
3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.1 Natural environment (Cont.)						
5. The student knows methods, instruments, and materials used in various sciences to study natural environments (e.g., field studies, laboratory analysis, use of model environments).	P I U H	K7	1 3 4	3	2.2.2 8.2	(C)Tools (V)Inquiry
6. The student is able to observe or experiment with organisms in a model environment (e.g., aquarium, terrarium).	P I U H	P11 P53	2 3 7 8 9		2.1.5.1 2.2.4	(V)Inquiry (V)Curiosity
7. The student is able to construct a model environment (e.g., aquarium, terrarium).	P I U H	P67	2 3 7 8 9		2.2.4	(V)Resourcefulness (V)Creativity (V)Natural state
8. The student is able to identify factors which cause changes or imbalances in natural or model environments.	P I U H	P42 P63	2 8 9			(V)Problem solving (V)Discrimination (V)Reasoning
9. The student knows that an environmental factor is any part of the environment which affects organisms, and to which they respond (e.g., chemicals, water, light).	I U H	K1 K2	3 4			

3. Biology
3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.1 Natural environment (Cont.)						
10. The student knows that environmental factors may be classified as biotic (living) or abiotic (nonliving).	I U H	K2 K5	3 4			
11. The student is able to collect data from natural environments on biotic and abiotic factors.	I U H	P33	1 2 3		2.1.3 2.2	(V)Inquiry (V)Organization
12. The student knows that range includes all the intensities of an environmental factor between a minimum and a maximum.	U H	K1 K2	3 4			
13. The student is able to identify the environmental factor as it occurs in an experiment or outdoors.	U H	P45	3 4			
14. The student knows that optimum range is that part of a range of an environmental factor in which an organism lives best.	U H	K2 K6	3 4			
15. The student is able to determine experimentally the optimum range of an environmental factor for an organism.	U H	P53	2 3			
16. The student knows ways in which natural environments meet the basic needs of organisms living in them.	P	K7 K8	4		3.1.3.1 3.3.3	

3. Biology
3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.1 Natural environment (Cont.)						
17. The student knows that organisms are affected by sudden natural changes in their habitats (e.g., earthquake, eruption, flood, fire).	P	K8	4			
18. The student knows that seasonal changes affect living organisms.	P	G2 K8	4			(C)Change
19. The student knows that weather conditions affect water, soil, plants, and wildlife.	P	G2 K8	4			
20. The student knows materials used by animals to construct homes in various biomes or habitats.	P	K7	4			
21. The student knows ways in which organisms affect the nonliving factors in their environments.	P	K8	4			
22. The student knows natural ways in which organisms aerate and enrich soil (e.g., activities of earthworms, decay of plants, animal feces and remains).	P I	K7 K8	4		6.3.2.6	

3. Biology
3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.2 The community						
1. The student knows that natural community refers to a group of organisms that live in the same area and are dependent on one another for food and other requirements; i.e., the interdependent population of a given area.	P I	K1 K2	3 4			(C)Community
2. The student knows meanings of terms used to describe relationships within a community (e.g., symbiotic, parasitic, covariant, parallel, competitive, predatory).	I U H	K1 K2	3 4		2.2.3	
3. The student knows that organisms in a community may be categorized as producers (plants), consumers (animals), and decomposers (molds, bacteria, yeast).	I U H	K1 K5	3 4			
4. The student knows the relationship between producers and consumers in a community.	I U H	K8	3 4			
5. The student is able to interpret data collected from natural environments regarding producer-consumer and biotic-abiotic relationships.	I U H	P32	1 2 3			(C)Data interpretation (V)Inquiry (V)Organization

3. Biology
3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.2 The community (Cont.)						
6. The student knows that competitors in a community are two or more organisms or populations using the same food, space, raw materials, light, etc.	I U H	K1 K2	3 4			
7. The student knows that dispersal refers to the movement of organisms beyond the border of the community.	I U H	K1 K2	3 4			
8. The student knows organisms and interactions characteristic of communities in various major biomes or habitats.	P I	K3 K5	4			(C)Adaptation (C)Environment
9. The student knows ways of observing natural communities with minimum interference in existing conditions.	P I	K2 K7	1 3 4		2.1.1	(V)Nature (V)Inquiry (V)Resourcefulness
10. The student is able to observe and record interactions between organisms in communities found in familiar local settings (e.g., school yard, pond).	P I	P11 P12 P32	2 3 7		2.1.1 2.1.2	
11. The student is able to tell which animals are in a region and what they are eating by interpreting feeding signs, tracks, droppings, etc.	P I	P42	2 3			

3. Biology
3.4 Natural systems
3.4.3 Ecosystem

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.1 General aspects						
1. The student knows a definition of ecosystem (e.g., a unit consisting of a community interacting with its physical environment; all interacting living and non-living components within a definable space).	P I U H	K1 K2	3 4		2.2.3	
2. The student knows that ecosystems are complex.	P I U H	G2 K3	1 4			(C)Systems (V)Nature (V)Diversity (V)Complexity
3. The student knows meanings of terms conventionally used in description or analysis of ecosystems, including stability, diversity, density, biomass, cycles, energy, matter, trophic level, steady state, etc.	I U H	K1 K2	3 4		2.2.3 7.1.2	
4. The student knows conventional methods of ecosystem analysis (e.g., census taking, environmental measurement).	U H	K2 K7	3 4		2.1.5.1 2.2.1	
5. The student is able to use conventional methods and instruments for analysis of ecosystems.	U H	P43	3 4		2.1.5.2 2.2	

3. Biology
3.4 Natural systems
3.4.3 Ecosystem

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.1 General aspects (Cont.)						
6. The student knows terms used to classify ecosystems (e.g., closed, open).	I U H	K1 K5	3 4		2.1.5.2 7.1.2	(C)Systems
7. The student knows that "closed ecosystems" are only relatively closed: they need energy from outside their limits.	I U H	K3 K5	4		3.1.3.1	(C)Energy (C)Systems
8. The student knows characteristics by which various kinds of ecosystems are distinguished.	I U H	K5 K9	3 4			
9. The student is able to classify ecosystems.	I U H	P33	2 3			
10. The student knows that ecology is the study of interrelationships between living things and their environment.	P I U H	K1 K2	1 3 4	3	8.2	(C)Ecology (V)Inquiry
11. The student knows that biomass is the weight of organic material under consideration.	H	K2	3 4		2.2.3 7.1.2	
12. The student knows that there is less biomass as one moves to higher consumer levels (e.g., biomass of lions compared to zebras).	H	G2 K10	3 4			
13. The student knows the relationships among biomass, density (members of organisms per unit area), and trophic levels.	H	K2 K10	3 4			

3. Biology
3.4 Natural systems
3.4.3 Ecosystem

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.1 General aspects (Cont.)						
14. The student knows that producers are organisms which capture light energy and use it to convert simple compounds to organic molecules which make chemical energy available to the rest of the ecosystem.	U H	K2 K4 K7	3 4		4.4 4.9.6	(C)Energy
15. The student knows that consumers are organisms which get energy from metabolic rearrangement of complex compounds gotten from other organisms (living or dead).	U H	K2 K7	3 4		4.4	(C)Energy
16. The student knows that barrier refers to any object or condition which prevents dispersal.	I U H	K1 K2	3 4			

3. Biology
3.4 Natural systems
3.4.3 Ecosystems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.2 Cycles and flow						
1. The student knows that "there is no 'away' to throw things".	P I U H	G2 K3	1 4 7	2		(V)Accuracy (V)Humor (V)Insight (V)Nature (V)Complexity
2. The student knows that matter cycles within an ecosystem while energy flows through it.	U H	G1 K4	3 4			(C)Energy (C)Systems
3. The student knows terms conventionally used to identify types of cycles, including biogeochemical, food-mineral, water, and atmospheric or gaseous.	I U H	K1	3 4			(C)Ecology
4. The student knows that biogeochemical cycles refer to the movement of elements from environment to organisms and back to the environment.	H	K1 K4	3 4		6.3.5	(C)Ecology
5. The student knows terms used in the study of biogeochemical cycles including nutrient cycling, reservoir pool, exchange or cycling pool, energy flow, feedback, cycling rates, turnover rate, turnover time, standing state, compartments, and pathways.	H	K1	3 4		2.2.3 6.3.5 7.1.2	(C)Ecology

3. Biology
3.4 Natural systems
3.4.3 Ecosystems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.2 Cycles and flow (Cont.)						
6. The student knows reservoir classifications of biogeochemical cycles (gaseous reservoirs in atmosphere or hydrosphere; sedimentary reservoir in the earth's crust).	H	K1 K5	3 4		6.3.5	(C)Ecology
7. The student knows ways in which concepts and data about biogeochemical cycles may be represented in various graphic forms including descriptions, tables, flow charts, maps, graphs.	H	K2	3 4			(C)Data representation
8. The student is able to represent data about biogeochemical interactions in appropriate graphic forms.	H	P66	2 3			(C)Data representation
9. The student knows that "food-mineral cycle" is the transfer of minerals from the soil to producers (where they are incorporated in the food manufactured by plants) to consumers, to decomposers, and then to the soil where they are available again for use by plants.	P I U	K2 K4	3 4			(C)Ecology
10. The student knows that "minerals" refers to the naturally occurring inorganic substances.	P I U	K1 K2	3 4		6.3.2.4	
11. The student knows that "raw materials" refers to the chemicals (such as water, carbon dioxide, oxygen, and minerals) which are incorporated into the food produced by green plants.	P I U	K1 K2	3 4			

3. Biology
3.4 Natural systems
3.4.3 Ecosystems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.2 Cycles and flow (Cont.)						
12. The student knows that "food" refers to that combination of raw materials which is used by plants and animals for nourishment.	P I U	K1 K2	3 4			
13. The student knows the path of food from plants to plant eaters and to animal eaters.	P I U	K4	4			
14. The student knows that food-mineral cycles may be represented in terms of food chains or food webs.	P I U	K2	3 4		2.2.4	(C)Data representation
15. The student knows that a food web is composed of interconnected food chains.	P I U H	K2	3 4			
16. The student knows that the terms "food web" and "food chain" refer to the transfer of energy from organisms to organism through repeated eating and being eaten, and to diagrams which represent the interconnected sequences.	I U H	K1 K2 K4	3 4			(C)Data representation
17. The student is able to represent food webs with diagrams.	I U H	P66	2 3			
18. The student is able to interpret diagrams showing the food web in an ecosystem.	I U H	P41	2 3			

3. Biology
3.4 Natural systems
3.4.3 Ecosystems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.2 Cycles and flow (Cont.)						
19. The student knows basic types of food chains including grazing chain (from green plant base to grazing herbivores to carnivores), and detritus chain (from dead or waste organic matter into microorganisms to detritus-feeding organisms and their predators).	U H	K2 K4 K5	3 4			
20. The student knows that detritus is decaying matter.	P I	K1 K2	3 4			
21. The student knows that decay is the breakdown of organic material due to the digestive action of microorganisms such as molds, bacteria, and yeast.	P I	K1 K8	3 4		3.2.3.3	
22. The student is able to recognize detritus in a model or natural ecosystem (e.g., terrarium, aquarium, pond).	P I	P45	2 3			
23. The student knows the implication of interruption or disruption of the "food web".	P I U H	K8	1 3 4 5		3.5.3	(C)Ecology
24. The student knows the basic water cycle.	P I	K2 K4	3 4		6.2.4.2 6.3.5.2	
25. The student knows that water is a necessary component of life as we know it.	P	G2 K3	4		3.1.3.3	

3. Biology
3.4 Natural systems
3.4.3 Ecosystems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.2 Cycles and flow (Cont.)						
26. The student knows ways in which organisms and physical factors interrelate with water cycles in ecosystems (e.g., plant roots hold soil, which holds water).	P I U H	K8	4		6.3.5	
27. The student knows terms used to identify the cycle of gas exchanges between organisms and environment, including oxygen-carbon dioxide cycle, gas cycle, and atmospheric cycle.	I U H	K1	3 4		2.2.3 6.3.5 7.1.2	
28. The student knows the basic oxygen-carbon dioxide cycle.	P I	K2 K4	3 4		3.1.3.3	
29. The student knows definitions of aerobic and anaerobic respiration.	U H	K2	3 4			
30. The student knows that most green plants in their normal environment produce more O_2 than CO_2.	I U H	G2 K7	4		3.1.3.3	
31. The student knows that organisms, during the process of aerobic respiration, use O_2 and produce CO_2.	U H	K7	4			
32. The student knows that some organisms respire anaerobically.	U H	K3 K7	4			
33. The student knows that organisms produce many end products (alcohols, organic acids, etc.) as a result of anaerobic respiration.	U H	K8	4			

3. Biology
3.4 Natural systems
3.4.3 Ecosystem

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.3.3 Regulation						
1. The student knows reasons why death is necessary for the stability of an ecosystem (e.g., detritus chain, population control).	P I U H	G2 K8	4			(C)Death (C)Ecosystem
2. The student knows there is a theorized direct correlation between ecosystem stability and species diversity (numbers of species present), productivity, complexity of interactions, etc.	H	G2 K8	4			
3. The student knows that the elimination or alteration of one factor in an ecosystem causes changes in its other factors.	I U H	G2 K8	4		3.5.3	(C)Ecosystem
4. The student knows ways in which plants and animals contribute to maintenance of steady-state in earth's temperature and air pressure conditions (e.g., through contribution to atmospheric oxygen which produces protective ozone layer).	U H	K7	1 4		6.3.5	(V)Nature (V)Interdependence (V)Insight
5. The student knows ways in which plants and animals interact to preserve the atmospheric balance of the planet (e.g., plants breathe in CO_2, breath out oxygen, animals breathe in oxygen, breathe out CO_2).	U H	K7	1 4		6.3.5	(V)Nature (V)Interdependence (V)Insight
6. The student is able to use terms, principles, and methods of systems analysis to study natural regulatory factors and processes within ecosystems.	H	P63	1 2 3		2.1.5.2 2.2.3	(C)Regulation (V)Inquiry (V)Resourcefulness

3. Biology

3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.4 Biome						
1. The student knows several major earth biomes.	P I U H	K3	3 4			
2. The student knows biotic and abiotic characteristics of major earth biomes.	P I U H	K3	4			
3. The student knows similarities and differences in definitions of biomes, habitats, ecosystems, communities, regions, etc., as conventionally used in various sciences.	U H	K1 K2 K5	1 3 4		2.2.3	(V)Communication (V)Inquiry (V)Clarity

3. Biology
3.4 Natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.5 Biosphere						
1. The student knows that the biosphere includes all of the volume of the earth system in which life exists and all of the interactions occurring in that volume.	I U H	K1 K2	3 4			(C)Systems (C)Life
2. The student knows that biogeography is the study of the interactions of living and non-living elements of the biosphere.	I U H	K1 K2	3 4			

3. Biology
3.4 Natural systems
3.4.6 Change through time

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.6.1 Origin of life						
1. The student knows the predominant theories concerning the origin of life (e.g., creation, spontaneous generation, source from outer space).	P I U H	G1 K4 K6	4		6.1.3.1	(C)Life (C)Theories
2. The student knows that historically, most human ideas about the origins of life have been expressed in religious, literary, or artistic forms.	P I U H	G2 K4	1 4			(C)Life (C)Culture (V)Culture
3. The student knows historic contributions of sciences and scientists to the development of theories about origins of life.	P I U H	K4	1 4	1		(C)History of science (C)Theories (V)Respect for others (V)Inquiry
4. The student knows current societal and scientific issues related to origins of life (e.g., social issues about what should be taught; scientific issues about validity of theories, hypothesis, principles).	I U H	K4 K9	1 3 4	2	Appendix I	(C)Life (C)Theories (V)Problem solving (V)Inquiry (V)Social sensitivity (V)Cultural heritage
5. The student is able to analyze or clarify issues related to validation or communication of scientific information about origins of life.	I U H	P63	1 2 3 5 9		1.1.3.2 2.1.5.2	(C)Life (C)Theories (V)Problem solving (V)Reasoning (V)Critical judgment (V)Respect for others (V)Self-knowledge (V)Self-respect (V)Self-confidence

3. Biology
3.4 Natural systems
3.4.6 Change through time

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.6.2 Change in existing organisms						
1. The student knows that his or her environment is constantly changing.	P	G1 K4	1 4	2 3 4 5		(V)Nature (V)Insight
2. The student knows that living things change through time.	P	G1 K4	1 4			(C)Life (C)Evolution (V)Nature (V)Insight
3. The student knows the evidence indicating that the single-celled organisms which developed in the early seas may have given rise to the many-celled organisms of later eras.	I U H	K3 K4	3 4		6.3.4.2	(C)Evolution
4. The student knows reasons for the importance of the evolution model to biological sciences.	I U H	G1 K8	1 4			(C)History of science (V)Inquiry
5. The student knows that humans have exercised artificial selection on natural populations with the result of increasing the rate and direction of change.	I U H	K8	4			
6. The student knows that Darwin's Theory of natural selection involves such concepts of overpopulation, variation, fitness to meet environmental stress, inheritance of traits, and genetic mutation.	I U H	G1 K3	1 4	1		(C)Evolution (V)Respect for others (V)Inquiry

3. Biology
3.4 Natural systems
3.4.6 Change through time

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.6.2 Change in existing organisms (Cont.)						
7. The student knows the main contributors to our present evolution model.	I U H	K1 K4	4	1		(C)History of science (V)Respect for others
8. The student knows factors of the evolutionary process which produce changes within a species.	I U H	K8	4			(C)Evolution (C)Genetics
9. The student knows that Darwin's Theory is based on the principle of uniformitarianism: that existing processes, acting in the same manner and intensity as at present, have been constant throughout time and are sufficient to account for all geological and biological changes.	H	G2 K4 K7	1 3 4			(C)Evolution (C)History of science (C)Theories (V)Objectivity
10. The student knows the principle of catastrophism: that physical and biological changes have in the past been brought about suddenly by physical forces operating in ways that cannot be observed today.	H	G2 K4 K7	1 3 4			(C)Evolution (C)History of science (C)Theories (V)Objectivity
11. The student knows that the uniformitarianist view is presently considered valid, and is basic to the concept of scientific laws.	H	G2 K8	4			(C)Theories (C)History of science

3. Biology
3.4 Natural systems
3.4.6 Change through time

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.4.6.2 Change in existing organisms (Cont.)						
12. The student knows historic and current advocates of uniformitarianism and catastrophism (e.g., Darwin, Velikovsky)	H	K1 K4	1 4	1		(C)History of science (V)Respect for others
13. The student knows values in conflict over current issues related to evolutionary theories (e.g., social issues about what should be taught; scientific issues about validity of theories, hypothesis, and principles).	I U H	K9	1 3 4		Appendix I	(C)Change, physical (C)Theories (C)Culture, contemporary (V)Freedom (V)Accuracy (V)Cultural heritage (V)Faith (V)Rationality
14. The student is able to analyze or clarify issues related to validation or communication of scientific principles, theories, and hypothesis about changes in organisms through time.	I U H	P63	1		1.1.3.2 2.1.5.2	(C)Change, physical (C)Theories (V)Problem solving (V)Reasoning (V)Critical judgment (V)Respect for others (V)Self-respect (V)Self-knowledge (V)Self-confidence

3. Biology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5 Human influence on natural systems						
1. The student knows the location and use of print and nonprint materials related to human influence on natural systems (e.g., card catalog: "Man-Influence of Environment," "Man-Influence on Nature," "Pollution," "Environmental Policy-U.S."; SUBJECT GUIDE TO BOOKS IN PRINT: "Environmental Engineering," "Environmental Pollution," "Natural Selection," "Nature Conservation," "Nature, Effect of Man on," "Man-Influence of Climate"; READER'S GUIDE: "Man-Survival," "Man-Influence of Environment," "Man-Influence on Nature"; LEARNING DIRECTORY: "Man, Environment," "Man, Evolutionary Development," "Population, Ecology").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

3. Biology
3.5 Human influence on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.1 Atmosphere (see also 6.3.5.3 Air						
1. The student knows that the atmosphere can be modified by humans through technological or natural means.	P I U H	K7 K8	4			(C)Ecology
2. The student knows technological wastes and by-products which modify the atmosphere (e.g., automobile exhaust, smoke from manufacturing plants).	P I U H	K3	3 4			
3. The student knows natural wastes and by-products which modify the atmosphere (e.g., smoke from field burning).	P I U H	K3	3 4			
4. The student knows chemical reactions which occur when various wastes and by-products are released in the atmosphere.	U H	K7 K8	4			
5. The student knows substances which humans consider "air pollutants" (substances added to the ecosystem in quantities harmful to organisms).	P I U H	K5	1 3 4			(C)Pollution (V)Discrimination
6. The student knows factors affecting local and global patterns of dispersal of substances released into the atmosphere (e.g., land forms, present weather conditions, wind patterns).	I U H	K6 K8	4		6.2.6	

3. Biology
3.5 Human influence on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.1 Atmosphere (Cont.)						
7. The student knows factors affecting rates of dispersal of substances added to the atmosphere (e.g., pressure and temperature conditions).	I U H	K3 K10	4			
8. The student knows that visibility, humidity, chemical makeup, chemical concentrations, etc. are measurable indicators of atmospheric conditions.	P I U H	K3 K9	4			(C)Pollution
9. The student knows how a pollution index is compiled and used.	U H	K2 K7	3 4			
10. The student knows methods and instruments used by scientists to detect and measure atmospheric modifications.	U H	K3 K7	1 3 4	1	6.2.8 6.2.9	(C)Tools (V)Respect for others (V)Inquiry
11. The student is able to obtain data on atmospheric conditions, using indicators and instruments appropriate to the degree of accuracy needed.	P I U H	P33 P65	1 2 3			(C)Pollution (V)Inquiry (V)Resourcefulness (V)Accuracy
12. The student is able to record and compare data on atmospheric conditions before and after modification, or over a period of time.	P I U H	P32 P35 P45	1 2 3		2.1.3 2.1.4	(C)Pollution (V)Inquiry (V)Resourcefulness (V)Organization

3. Biology
3.5 Human influence on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.1 Atmosphere (Cont.)						
13. The student knows ways in which human activities alter the natural regulation of atmospheric composition, temperature, and pressure (e.g., increase in ozone layer).	P I U H	K8	1 4			(C)Pollution (V)Insight
14. The student knows ways in which human alterations of weather affect other factors in an ecosystem.	P I U H	K8	1 4		3.4.3 6.2.9	(C)Ecology (V)Nature (V)Inquiry (V)Insight
15. The student is able to identify problems and issues related to air pollution.	P I U H	P44	1 2		Appendix I	(C)Pollution (V)Social sensitivity (V)Problem solving
16. The student is able to identify problems and issues related to human regulation or alteration of weather.	I U H	P44	1 2		Appendix I	(V)Social sensitivity (V)Problem solving
17. The student is able to use scientific processes and conventions to analyze problems and issues related to human influences on the atmosphere.	U H	P63	1 2 3 5		1.1.3.2 2.1.6	(V)Problem solving (V)Resource-fulness
18. The student is able to evaluate the validity and significance of various scientific predictions about the short and long term effects of atmospheric modification.	H	P21 P22 P24	1 2 3 5	1	2.1.2	(V)Critical judgment (V)Responsibleness (V)Problem solving (V)Accuracy (V)Prediction (V)Respect for others

3. Biology
3.5 Human influences on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.2 Soil (see also 6.3.5.1 Soil)						
1. The student knows human activities which modify soils directly or indirectly (e.g., tilling, planting, grazing animals, logging, paving, fertilizing, bombing, mining, burying wastes, spraying crops).	P I U H	K3 K8	4			(C)Ecology
2. The student knows soil properties which can be changed by human activities or their by-products (e.g., chemical composition, consistency, location).	P I U H	K3 K8	4			(C)Ecology
3. The student knows the effects on soils of some common agricultural chemicals, and the way these additives affect other factors in an ecosystem (e.g., nitrates, pesticides).	I U H	K4 K8	4			(C)Pollution (C)Ecology
4. The student knows techniques developed by agricultural sciences to prevent over-use of soils or exhaustion of soil nutrients (e.g., crop rotation, mulching, use of cover crops, fertilization programs).	I U H	K3 K4	1 4	1		(C)Conservation (V)Respect for others (V)Nature
5. The student knows techniques developed by farmers or agricultural scientists to prevent soil erosion, flooding, draught, wind damage, etc. (e.g., terracing, cover crops, irrigation systems).	P I U H	K3 K8	1 3 4	1		(C)Conservation (V)Respect for others (V)Nature

3. Biology
3.5 Human influences on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.2 Soil (Cont.)						
6. The student is able to plan and carry out personal actions to protect or enrich soil in his or her own area (e.g., garden, yard, schoolyard).	P I U H	P62 P65	1 2 7 8 9	2		(C)Conservation (V)Responsibleness (V)Self-direction (V)Decision making (V)Problem solving
7. The student knows ways in which human alterations of land forms affect the other factors in an ecosystem and the stability of the ecosystem (e.g., building houses on sand dunes, logging mountainsides, cutting and laying roads).	I U H	K3 K8	4			(C)Ecology
8. The student knows methods and instruments used by scientists to measure effects of soil modification or alteration.	U H	K3 K7	1 3 4	1	2.2	(C)Tools (C)Pollution (V)Problem solving (V)Respect for others (V)Inquiry
9. The student is able to identify problems and issues related to human use or pollution of soils.	P I U H	P44	1 2 3		2.1.5	(C)Pollution (V)Problem solving (V)Social sensitivity
10. The student is able to analyze or clarify problems and issues related to human use or pollution of soils.	P I U H	P43 P63	1 2 3		1.1.3.2 2.1.5	(C)Pollution (V)Problem solving (V)Reasoning (V)Complexity

3. Biology
3.5 Human influence on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.3 Water (see also 6.3.5.2 Water)						
1. The student knows physical and chemical properties of water.	P I U H	K3	4			
2. The student knows human activities which modify aquatic systems either directly or indirectly (e.g., dam building, land reclamation, waste disposal, building on shorelines or riverbanks, dredging, bombing, offshore mining, agricultural spraying).	P I U H	K3 K8	4		6.3.7.2	(C)Pollution
3. The student knows human activities which modify water cycles directly (e.g., cloud seeding).	I U H	K3 K8	4			
4. The student knows human activities which affect ground water, water tables, or drainage systems either directly or indirectly (e.g., underground explosions, underground storage of wastes or poisons, damming and irrigating, use of agricultural chemicals).	I U H	K3 K8	4			
5. The student knows that humans depend on water and water systems for physical survival and for societal activities (e.g., drinking, washing, irrigation of crops, transportation, energy source, food source, recreation).	P I U H	K3 K10	1 4			(C)Ecology (V)Interdependence (V)Survival (V)Quality of life

3. Biology
3.5 Human influence on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.3 Water (Cont.)						
6. The student knows that water may be "polluted" (modified by addition of substances in quantities harmful to organisms) naturally or through human intervention.	P I U H	K3 K8	4			(C)Pollution
7. The student knows methods and instruments used by scientists to determine water quality.	I U H	K3 K7	3 4	1	2.2	(C)Tools (V)Respect for others (V)Inquiry
8. The student is able to identify polluted water, using various tests and indicators.	I U H	P47	1 2 3	2		(V)Survival (V)Resourcefulness (V)Inquiry
9. The student is able to measure concentrations of substances in water, using instruments and methods appropriate to the degree of accuracy needed.	P I U H	P35	1 2 3		2.2.1 4.3	(V)Resourcefulness (V)Accuracy (V)Discrimination
10. The student knows ways of purifying water for drinking.	U H	K7	1 3 4			(V)Survival (V)Resourcefulness (V)Self-confidence (V)Physical well-being
11. The student is able to identify problems and issues related to water pollution, water conservation, or allocation of water resources.	P I U H	P45	1 2		Appendix I	(C)Pollution (V)Social sensitivity (V)Problem solving

3. Biology
3.5 Human influence on natural systems
3.5.1 Physical changes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.1.3 Water (Cont.)						
12. The student is able to analyze or clarify problems and issues related to human influences on water systems.	P I U H	P43 P63	1 2 3		1.1.3.2 2.1.5	(C)Pollution (C)Conservation (V)Problem solving (V)Reasoning (V)Complexity
13. The student is able to plan and carry out personal actions related to prevention or alleviation of water pollution in his or her own area.	P I U H	P62 P65	1 2 5 9			(C)Conservation (V)Problem solving (V)Decision making (V)Responsibleness (V)Self-direction
14. The student is able to plan and carry out personal actions to avoid waste or overuse of hydro-electric power.	P I U H	P62 P65	1 2 5 9			(C)Conservation

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.2 Biological changes						
1. The student knows that human activities can directly cause changes in the structures and functions of individual organisms (e.g., removing organs, transplanting or grafting plants, fertilizing, treating with herbicides).	P I	G2 K8	4			
2. The student knows that human activities can indirectly cause changes in structures and functions of individual organisms by altering environmental factors.	P I	G2 K8	1 4		3.4.1 6.3.5	(C)Ecology (V)Interrelatedness
3. The student knows that human activities can cause changes in populations and communities of organisms (e.g., relocating, altering growth rates, eliminating species or varieties).	P I U	G2 K8	1 4		3.3.2.2 3.4.2	(C)Ecology (V)Interrelatedness
4. The student knows that humans can directly alter or influence the genetic structures of organisms (e.g., selective breeding, alteration of chromosomes, etc. through chemical, electronic, nuclear technology).	I U H	K8	4		3.1.3.5	
5. The student knows ways in which human activities affect the gene pools of populations, purposely or incidentally (e.g., isolation of populations as civilization expands; selective breeding; increase in mutations due to radioactivity; genetic adaptations to drugs, chemicals, etc.).	U H	K8	4		3.3.3	

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.2 Biological changes (Cont.)						
6. The student knows that organisms, populations, and communities of organisms undergo changes in response to modification of biotic or abiotic factors in their environment or ecosystem.	I U H	G2 K8	4		3.4	
7. The student is able to infer from observation or data the chains of causes and effects which occur when one factor is altered in a closed ecosystem or model environment (e.g., terrarium, aquarium).	I U H	P42	2 3		2.1.4.2 3.4.1	
8. The student is able to predict effects on organisms of a modification of one factor in their ecosystem.	I U H	P51	1 2			(C)Ecology (V)Prediction
9. The student is able to formulate and test hypotheses about the effects on organisms of an induced change in an environmental factor.	I U H	P51 P53	1 2 3 8 9			(C)Ecology (V)Inquiry (V)Problem solving (V)Resourcefulness (V)Self-confidence (V)Insight
10. The student knows methods, instruments, and materials used by scientists to study short and long term effects of technology, industry, agriculture, etc., on organisms, populations, and communities.	I U H	K3 K7	3 4	1		(C)Ecology (C)Tools (C)Research (V)Respect for others (V)Inquiry (V)Problem solving (V)Survival

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.3 Consequences of change						
1. The student knows that not all organisms respond to a given change in the same way.	P	G2 K8	4			(C)Change
2. The student knows that some changes will favor some organisms and harm others.	P	G2 K8	4			(C)Change
3. The student knows some species which are in danger of extinction, and the human activities which may have contributed to this condition.	P I U	K5 K8	4		3.2.3.3	
4. The student knows some populations or species which have experienced increased growth rates as a result of human activities (e.g., staphylococcus).	P I U	K5 K8	4		3.3.1.1	
5. The student knows that humans, as factors in a closed ecosystem (the biosphere), are affected by changes in other factors.	I U H	G2 K8	1 4			(C)Ecology (V)Self-knowledge
6. The student knows that some human activities have induced environmental changes which currently threaten resources necessary to human survival (e.g., patable water supply, oxygen, food, power sources, living space).	I U H	K8	1 4			(C)Ecology (V)Self-knowledge (V)Inter-relatedness

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.3 Consequences of change (Cont.)						
7. The student knows ways in which human activities can modify both the quantity and quality of environmental factors needed for human life (e.g., using up resources; disposing of wastes; storing and testing chemical, biological, and nuclear weapons).	I U H	K8	4			(C)Ecology (V)Self-knowledge (V)Inter-relatedness
8. The student is able to distinguish between renewable and nonrenewable resources.	P I U	P45	2			
9. The student is able to distinguish between substances which are biodegradable and those which are not.	P I U	P45	1 2 3			(V)Discrimination (V)Utility
10. The student knows methods, principles and instruments used by scientists to predict and evaluate effects of various waste disposal systems.	U H	K3 K7	1 3 4	1		(C)Tools (V)Respect for others (V)Inquiry
11. The student knows effects of various industrial, agricultural, and domestic wastes and by-products on environmental elements needed for human survival.	H	K8	4			(C)Pollution

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.3 Consequences of change (Cont.)						
12. The student knows methods, instruments, and materials used by science and medicine to determine short and long term effects on humans of consumption of or exposure to various chemical or radioactive wastes.	H	K3 K7	3 4			
13. The student knows methods, instruments and materials used in science and medicine to determine human tolerances to various chemical and radioactive wastes.	H	K3 K7	3 4			
14. The student knows procedures, materials, and devices developed to combat or alleviate effects of various pollutants on human beings.	I U H	K3 K7	1 3 4	1		(V)Problem solving (V)Social concern (V)Respect for others
15. The student knows procedures, materials and technological devices developed to minimize pollution of air, water, etc.	P I U H	K3 K7 K9	1 3 4	1		(C)Conservation (C)Pollution (C)Research (C)Technology (V)Respect for others (V)Inquiry (V)Problem solving
16. The student knows organizations, legislation, programs, etc. developed to aid in solving societal problems of waste disposal and resource consumption.	P I U H	K3 K4 K7	1 3 4	1		(C)Regulation (V)Respect for others (V)Cooperation (V)Community

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.3 Consequences of change (Cont.)						
17. The student is able to identify problems and issues related to ecological effects of human resource consumption.	P I U H	P44	1 2 3		2.1.5 Appendix I	(V)Inquiry (V)Problem solving (V)Social sensitivity
18. The student is able to identify problems and issues related to ecological effects of waste disposal.	P I U H	P44	1 2 3		2.1.5 Appendix I	(V)Inquiry (V)Problem solving (V)Social sensitivity
19. The student is able to identify problems and issues related to ecological effects of development, testing, storage and use of modern weapons.	P I U H	P44	1 2 3		2.1.5 Appendix I	(V)Inquiry (V)Problem solving (V)Social sensitivity
20. The student is able to identify problems and issues related to the growth rate of human population, overcrowding, stress, etc.	P I U H	P44	1 2 3		3.3	(V)Inquiry (V)Problem solving (V)Social sensitivity
21. The student knows values in conflict over issues related to human modifications of the environment.	I U H	K3	1 4 5		1.1.3.2 2.1.5	
22. The student knows that modern civilization faces a dilemma of conflicting dependencies. in order to maintain the technological and commercial systems we need in a highly organized society, we must alter internal balances in the natural systems we depend on to maintain life.	U H	G2 K8	1 4	2		(C)Society (C)Ecology (V)Complexity (V)Inter-dependence (V)Respect for others

3. Biology
3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.3 Consequences of change (Cont.)						
23. The student is able to analyze or clarify issues and problems related to the cycle of human needs: human activity; environmental modification; threat to life.	U H	P63	1 2 3 5	2 4 5	1.1.3.2 2.1.5	(C)Ecology (C)Society (V)Problem solving (V)Inquiry (V)Self-direction (V)Responsibleness (V)Social concern
24. The student knows possibilities currently being researched and evaluated by various sciences as alternatives to existing life-support systems.	U H	K3 K10	1 4			(C)Research (V)Social sensitivity (V)Survival (V)Problem solving (V)Inquiry (V)Respect for others (V)The unknown
25. The student knows that futuristics is a scientific discipline concerned with accurate and comprehensive prediction of effects, trends, consequences, based on statistical analysis (usually computer-assisted) of data from biological, physical, and social sciences, government agencies, industry, commerce, etc.	H	K1 K2	1 3 4 5	1 3	8.2.5	(C)Research (V)Respect for others (V)Inquiry (V)Prediction (V)Accuracy (V)The unknown (V)Problem solving (V)Social concern
26. The student knows that the study of alternative futures involves statistical prediction, analysis, and evaluation of alternative proposals for solutions to ecological and social problems.	H	K2	1 3 4 5	1 3	8.2.5	(C)Research (V)Respect for others (V)Inquiry (V)Prediction (V)Accuracy (V)The unknown (V)Problem solving (V)Social concern

3. Biology

3.5 Human influence on natural systems

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
3.5.3 Consequences of change (Cont.)						
27. The student is able to evaluate his or her own behavior in terms of its effects on present and future environment.	H	P65	1 2 5 8	2 4 5	2.1.6.2 Appendix I	(V)Self-direction (V)Self-discipline (V)Environment (V)Prediction
28. The student is able to accurately predict effects of his or her behavior on the lives of other living organisms.	H	P51	1 2 3 5 8	2 4	2.1.4.2	(V)Accuracy (V)Prediction (V)Self-knowledge (V)Environment
29. The student is able to plan and carry out a course of action based on thoughtful consideration of predicted consequences to other living organisms.	H	P62 P65	1 2 5 8	4 5	2.1.6.2	(C)Behavior (C)Ecology (V)Responsibleness (V)Self-direction (V)Rationality (V)Decision making (V)Quality of life (V)Prediction

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1 Matter						
1. The student knows the location and use of print and nonprint materials related to matter (e.g., card catalog: "Matter," "Atomic Theory," "Chemical Elements"; SUBJECT GUIDE TO BOOKS IN PRINT: "Atomic Spectra," "Atomic Theory," "Matter-Constitution"; READER'S GUIDE: "Chemical Bonds," "Chemical Compounds," "Molecules"; LEARNING DIRECTORY: "Matter, Molecule," "Matter, Property," "Ion," "Atom Molecule"; area and building audio-visual catalogs: "Matter," "Atoms," "Mass").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

4. Chemistry

4.1 Matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.1 Characteristics						
1. The student knows that space is defined to be the expanse in which all matter exists.	P I U H	K2	3		2.2.3	
2. The student knows that anything which occupies space is defined to be matter.	P I U H	K2 K3	3		2.2.3 5.8.1	(C)Matter
3. The student knows that the terms "object" and "substance" are general names for matter.	P I U H	K1	3 4		2.2.3 5.8.1	(C)Matter
4. The student knows that chemistry is defined to be the branch of science which deals mainly with the composition of matter and the changes which matter undergoes.	P I U H	K2	3 4		2.2.3	
5. The student knows that a chemical change takes place when existing chemical bonds in a molecule are broken and/or new chemical bonds are formed.	P I U H	K2	4			(C)Change, chemical
6. The student knows that a physical change is one in which matter is noticeably changed.	P I U H	K2	4		5.8.1	(C)Change, physical
7. The student knows that the products arising from a change in matter may be in several different forms of matter and energy.	I U H	K3	4		5.8.1	(C)Change (C)Matter
8. The student knows that matter-energy is conserved in chemical reactions.	I U H	K2	4			(C)Energy conservation

4. Chemistry
4.1 Matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.1 Characteristics (Cont.)						
9. The student knows that in chemistry the particular substances involved and their immediate environment are defined as a system.	I U H	K2	3		2.2.3	(C)System
10. The student knows that changes in matter are either natural or artificial (man-initiated).	P I U H	K3 K8	4			(C)Change (C)Matter

4. Chemistry
4.1 Matter
4.1.1 Characteristics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.1.1 Mass						
1. The student knows that mass is defined to be the amount of matter in an object.	I U H	K2	3		2.2.3 5.1.2	(C) Matter
2. The student knows that the total mass of a quantity of like particles is a measure of the total number of like particles.	U H	K2 K10	3 4		5.1.2	
3. The student is able to measure the mass of a substance.	U H	P35	2 3		2.1.4.5 5.1.2	

4. Chemistry
4.1 Matter
4.1.1 Characteristics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.1.2 Volume						
1. The student knows that the volume of an object is defined as the amount of space it occupies.	P I U H	K2	3		2.2.3	

4. Chemistry
4.1 Matter
4.1.1 Characteristics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.1.3 Density						
1. The student knows that density is defined to be the ratio of the mass of an object to its volume.	I U H	K2	3		2.2.3	
2. The student knows that objects more dense than water will sink; less dense than water will float (e.g., liquid-liquid; liquid-solid; gas-gas).	P I U H	K3	4			
3. The student knows that different liquids may seek different levels in a mixture.	P I U H	K3 K5	4		5.8.2	
4. The student knows that there is a relationship between the densities of liquids and their tendency to form layers.	P I U H	K3 K8	4		5.8.2	

4. Chemistry
4.1 Matter
4.1.2 Structure

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.2.1 Atoms						
1. The student knows that the proton is defined as having a positive charge of unity.	U H	K2	3		2.2.3 5.8.1	(C)Atom
2. The student knows that the electron is defined as having a negative charge of unity.	U H	K2	3		2.2.3 5.8.1	(C)Atom
3. The student knows that the neutron is defined as having a neutral charge.	U H	K2	3		2.2.3 5.8.1	(C)Atom
4. The student knows that the rest mass of a proton is approximately several thousand times that of an electron and about the same as that of a neutron.	H	K3 K10	3 4		5.8.1	(C)Atom
5. The student knows that the atomic number of an atom indicates the number of protons or the number of electrons in the atom.	H	K2 K3	3 4		2.2.3 5.8.1	
6. The student knows that an atom is considered to be derived from protons, neutrons, and electrons.	H	G2 K3	4			(C)Atom
7. The student knows that almost the entire mass of an atom is considered to be located in the nucleus.	H	K6	4			(C)Atom
8. The student knows that an atom has no net electrical charge.	H	K3	4			(C)Atom
9. The student knows that the atomic number of an atom indicates the units of positive charge or the units of negative charge in a neutral atom.	H	K2	3		2.2.3 5.8.1	

4. Chemistry
4.1 Matter
4.1.2 Structure

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.2.1 Atoms (Cont.)						
10. The student knows that the atom is considered to be the smallest unit of an element.	H	K2	4		2.2.3 5.8.1	(C)Atom
11. The student knows that a chemical symbol is one or two letters used to represent a particular element. The first letter is always capitalized, while the second letter is not.	I U H	K2	3		2.2.3	
12. The student knows that in the Dalton atomic model, the atom is compared to a billiard ball with a discrete mass but no discrete structure.	H	K5	3 4			(C)Atom
13. The student knows that in the Bohr atomic model the nucleus of the atom is compared to the sun and the electrons to the planets in our solar system.	U H	K5	3 4			(C)Atom
14. The student knows that in the wave mechanical atomic model, electrons occur in three-dimensional standing matter waves associated with one or more nucleons.	H	K3	3 4			(C)Atom
15. The student knows that the Dalton atomic model is most useful in all atom counting processes (chemical composition).	H	K3 K6	3 4			
16. The student knows that the wave mechanical atomic model is most useful for the study of bonding and the geometrical consequences of bonding.	U H	K3 K6	3 4		4.1.3	

4. Chemistry
4.1 Matter
4.1.2 Structure

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.2.1 Atoms (Cont.)						
17. The student is able to sketch a Bohr model of an atom, identifying the nucleus and electrons.	U H	P76	2 3		2.1.6.4	
18. The student knows that in the Bohr model and the wave mechanical model of an atom, the nucleus is considered to be the central part and contains the nucleons.	H	K3	3 4			(C)Atom
19. The student is able to compare Bohr atomic models of isotopes.	H	P45	2		2.1.4.5	
20. The student knows that isotopes differ only in the number of neutral nucleons contained in the nuclei.	H	K5	3 4			
21. The student knows that the principal quantum number in the Bohr model of atoms corresponds to the orbits of the electrons.	H	K3 K10	3			
22. The student knows that each electron of an atom is designated by four quantum numbers.	H	K3	3			
23. The student knows that in a given atom, no two electrons have the same four quantum numbers.	H	K3	3			
24. The student knows that the first quantum number, n, designates the main energy level of the electron.	H	K1 K2	3			
25. The student knows that the second quantum number, l, designates the shape of the standing matter wave.	H	K1 K2	3			

4. Chemistry
4.1 Matter
4.1.2 Structure

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.2.1 Atoms (Cont.)						
26. The student knows that the third quantum number, m, designates the number of standing matter waves of a given kind per main energy level.	H	K1 K2	3			
27. The student knows that the fourth quantum number, m_s, designates the two ways in which an electron may be aligned with a magnetic field.	H	K1 K2	3			
28. The student is able to compute the number of electron orbitals possible at each energy level of an atom, using the wave mechanics model of atoms.	H	P35	2 3			
29. The student knows that there is a tendency for atomic radii to decrease from left to right in a period of the Periodic Table.	H	K3	4			
30. The student knows that there is an increasing tendency of atoms in A families (Groups I-VIII, the representative elements) to gain electrons (electronegativity) from left to right in a period of the Periodic Table.	H	K3	4			
31. The student knows that there is an increasing tendency to lose electrons from top to bottom in an A family (Groups I-VIII, the representative elements) of the Periodic Table.	H	K3	4			

4. Chemistry
4.1 Matter
4.1.2 Structure

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.2.2 Ions						
1. The student knows that an ion is defined as an atom or a group of atoms bonded together having a net electrical charge.	U H	K2	3		2.2.3	(C)Atom
2. The student knows that an ion is formed when one or more electrons are removed from or added to a neutral atom or a group of atoms bonded together.	U H	K2	3 4		4.1.3	
3. The student knows that ionization energy is defined as the energy required to remove an electron from a neutral atom.	H	K2	3		2.2.3	
4. The student knows that there are only two types of ions: negative ions called anions and positive ions called cations.	U H	K1 K2	3 4		2.2.3	
5. The student knows that ions and atoms of the same element have different properties.	U H	K3 K5	4			
6. The student knows that each element may have more than one type of ion.	U H	K3	4			
7. The student knows that differently charged ions of the same element have different properties.	U H	K3 K5	4			

4. Chemistry
4.1 Matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.3 Bonding						
1. The student knows that "chemical bond" is defined as the set of forces which holds atoms or ions together in a molecule.	U H	K2	3		2.2.3	
2. The student knows that a covalent bond results from electron sharing.	H	K3 K8	3 4			
3. The student knows that ions of opposite charge are held together by an ionic bond.	H	K3 K8	3 4			
4. The student knows that a metalic bond consists of a rigid lattice of positive ions around which there is a mobile sea or atmosphere of valence electrons.	H	K3	3 4			
5. The student knows that the attraction between ions is coulombic, thus acting equally in all directions and attracting unlike charges at relatively long distances.	H	K3	4			
6. The student knows that covalent bond forces are strong only at short range and are highly directional.	H	K3	4			
7. The student knows that ions and molecules can be polarized so that the charge density is unsymmetrical, resulting in a dipole or polar bond.	H	K3 K8	4			

4. Chemistry

4.1 Matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.4 Molecules						
1. The student is able to identify the elements and the number of atoms of each element represented by the molecular formula of a given molecule.	U H	P41	2 3		2.1.4.1	
2. The student is able to predict alternative shapes for molecules.	U H	P51	2		2.1.5.1	
3. The student is able to represent the geometrical arrangement of atoms in molecules using (Dreiding) models or their equivalent drawings.	I U H	P76	2 3		2.1.6.4	

4. Chemistry
4.1 Matter
4.1.4 Molecules

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.4.1 Elements						
1. The student knows that an element contains only one kind of atom.	U H	K3	3			
2. The student knows that atoms of the same element may have different weights and are called isotopes.	U H	K1 K2 K3	3 4		2.2.3	
3. The student knows that molecules of elements consist of one atom or two or more atoms bonded together.	U H	K3	3 4			
4. The student knows that an element consists of an atom or atoms of the same atomic number in contrast to a compound which consists of atoms of different atomic numbers.	U H	K3 K5	3			
5. The student knows that each element has a set of chemical and physical properties shared by no other element or compound.	U H	K3 K5	4			
6. The student knows that in the periodic table, the elements are arranged in the order of increasing atomic numbers.	U H	G2 K3 K6	3			
7. The student knows that when the elements are placed in the order of their atomic number, particular characteristics of the elements recur in a periodic manner.	U H	K3	3			
8. The student knows that the horizontal rows of a periodic table of the elements are called periods.	U H	K1 K2 K6	3		2.2.3	

4. Chemistry
4.1 Matter
4.1.4 Molecules

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.4.1 Elements (Cont.)						
9. The student knows that the eighteen vertical columns of the extended form of the periodic table of the elements are called families and contain those elements which have similar chemical properties.	U H	K1 K2	3		2.2.3	
10. The student knows that the eight vertical columns of the short form of the periodic table of the elements are called groups and contain those elements which have the same number of valence electrons.	U H	K1 K2 K3	3		2.2.3	
11. The student knows that chemical families of a periodic table are subsets of the chemical groups of elements, and that the chemical properties of the elements are more nearly alike within a family than they are between the families in a group.	U H	K3 K5	3 4			
12. The student knows that atomic radius is a periodic property of elements.	U H	K3	4			
13. The student knows that all the elements may be classified as either metals or nonmetals.	I U H	K5	3			
14. The student knows that metals are on the left side of the periodic table.	U H	K6	3			
15. The student knows that nonmetals are on the right side of the periodic table.	U H	K6	3			

4. Chemistry
4.1 Matter
4.1.4 Molecules

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.4.1 Elements (Cont.)						
16. The student knows that electronegativities of nonmetals range upwards from 2.2 while those of metals range downward from 2.2.	H	K3 K5	4			
17. The student knows that metals tend to have a high degree of electrical and thermal conductivity, a definite luster, a close-packed arrangement of atoms, and the ability to change shape under strain without cracking.	U H	K3	4			
18. The student knows that nonmetals lack electrical and thermal conductivity, a definite luster, a close-packed arrangement of atoms, and the ability to change shape under strain without cracking.	U H	K3	4			
19. The student knows that nonmetals tend to act as electron acceptors and form acidic oxides.	H	K3 K7	4			
20. The student knows that metals tend to act as electron donors and form basic oxides.	H	K3 K7	4			

4. Chemistry
4.1 Matter
4.1.4 Molecules

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.4.2 Compounds						
1. The student knows that compounds consist of two or more different elements bonded together.	U H	K3	3			
2. The student knows that a compound consists of molecules composed of two or more kinds of atoms.	U H	K3	3			
3. The student knows that common materials can be identified by physical and chemical properties.	I U H	K3 K5	4			
4. The student knows that each compound has a set of chemical and physical properties shared by no other compound.	U H	K3 K5	4			
5. The student knows IUPAC (International Union of Pure and Applied Chemistry) nomenclatures for chemical compounds.	U H	K1	3		2.2.3	
6. The student knows differences between compounds and mixtures.	U H	K5	3 4			
7. The student knows that the principal structural difference between covalent and ionic compounds is that the former exist as discrete molecules, each containing a definite number.	H	K3 K5	3 4			

4. Chemistry
4.1 Matter
4.1.4 Molecules

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.1.4.2 Compounds (Cont.)						
8. The student knows the Law of Multiple Proportions: if the same two elements combine to form more than one compound, the mass of one element which combines with a fixed mass of the other element will be in a small whole number ratio.	H	G1 K2	3			
9. The student knows the Law of Definite Proportions: for every sample of a particular compound the proportions by mass of the elements which make up the compound are always the same.	H	G1 K2	3			
10. The student knows that, as a result of a chemical reaction, the atoms which make up the product molecules are those which were present in the reactant molecules.	U H	K8	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2 States of matter						
1. The student knows the location and use of print and nonprint materials related to states of matter (e.g., card catalog: "Gases," "Liquids," "Crystallography"; SUBJECT GUIDE TO BOOKS IN PRINT: "Gases," "Gases-Liquefaction," "Liquids," "Solids," "Crystals"; READER'S GUIDE: "Gases," "Liquids," "Diffusion," "Solids"; LEARNING DIRECTORY: "Amorphous Body," "Solid Chemicals," "Gas Dynamics," "Liquid, Density"; area and building audiovisual catalogs: "Gases," "Liquids").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that the size of atoms and molecules remains constant in all three phases of matter.	I U H	G2 K3	4		5.8.2	
3. The student knows that each elemental substance may exist as a gas, liquid, or solid, depending on the temperature.	P I U H	K3 K8	4		5.8.2	
4. The student knows that the gas, liquid, and solid states are called phases.	P I U H	K1	3		2.2.3 5.8.2	
5. The student knows that neither matter nor energy can be created or destroyed, but both matter and energy can be changed from one form to another.	I U H	G1 K3	4		5.8.1 5.9.5	(C)Matter (C)Energy
6. The student knows that some changes in matter require the input of energy, while other changes give off energy.	I U H	K3 K5	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2 States of matter (Cont.)						
7. The student knows that any change in matter involves energy.	I U H	K3 K8	4		5.8.1	
8. The student knows that there is a specific temperature at which phase changes take place.	P I U H	K3 K6 K8	3		5.8.2	(C)Change

4. Chemistry

4.2 States of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.1 Gases						
1. The student knows that gases are composed of molecules which are widely separated from one another in otherwise empty space.	U H	K3	4		5.8.2	
2. The student knows that gas molecules move at high speeds, traveling in straight paths but in random directions.	U H	K3	4		5.8.2	
3. The student knows that gas molecules collide with one another, but the collisions result in no loss of energy.	U H	K3 K8	4		5.8.2	
4. The student knows that the average velocity of gas molecules increases as the temperature increases and decreases as the temperature decreases.	H	K8	4		5.8.2	
5. The student knows that individual gas molecules in a sample of a pure gas are not moving at the same speed, but for a given gas at a given temperature the average velocity is the same in all samples regardless of the pressure.	H	K3 K5 K8	4		5.8.2	
6. The student knows that at a given temperature, the molecules of all gases have the same average kinetic energy; thus an increase in mass is compensated for by a decrease in average speed.	H	K3	4		5.5.3 5.8.2	

4. Chemistry

4.2 States of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.1 Gases (Cont.)						
7. The student knows that a gas is a state of matter which has no definite volume or shape (it tends to occupy all of the space available).	U H	K3	3		5.8.2	
8. The student knows that pressure, temperature, and number of gas molecules will influence the volume which a gas occupies.	U H	K8	4		5.8.2	
9. The student knows that the volume of a certain mass of gas is inversely proportional to the pressure at constant temperature (Boyle's Law).	H	G1 K2 K8	3			
10. The student knows that the volume of a given mass of gas is directly proportional to the absolute temperature at constant pressure (Charles' Law).	H	G1 K2 K8	3			
11. The student knows that the pressure of a given mass of gas is directly proportional to the absolute temperature if the volume does not change (Gay-Lussac's Law or Amonton's Law).	H	G1 K2 K8	3			
12. The student knows that the total pressure in a mixture of gases is the sum of the individual partial pressures (Dalton's Law).	H	G1 K2 K8	3			
13. The student knows that equal numbers of molecules are contained in equal volumes of different gases if the pressure and temperature are the same (Avogadro's Law).	H	G1 K2 K8	3			

4. Chemistry

4.2 States of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.1 Gases (Cont.)						
14. The student knows that the Ideal Gas Law is the combined single statement of Boyle's, Charles', Gay-Lussac's, and Avogadro's Laws (PV=nRT).	H	G1 K2	3			
15. The student knows that gases are more soluble in liquids when the gases are at lower temperatures than when they are at higher temperatures.	U H	G2 K3	4			
16. The student knows that there are changes in air as one moves away from the earth.	P I U H	K3 K6	4			
17. The student knows that everything that exists on earth is at the bottom of a volume (ocean) of air.	P I U H	G2 K3 K6	4			
18. The student knows that gases may dissolve in water.	I U H	K3	4		6.3.5.2	
19. The student knows that pure air is an invisible, tasteless, odorless gas whose properties may change when other substances are mixed with it.	P I U H	K2 K3	4			
20. The student knows that air occupies space.	P I U H	K3	4			
21. The student knows that air surrounds the earth and is called the atmosphere.	P I U H	K1 K3	4		2.2.3 6.2.2	(C)Universe

4. Chemistry
4.2 States of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.1 Gases (Cont.)						
22. The student knows that air is composed of many different gases, each having its own properties.	P I U H	K3	4		6.2.2	
23. The student knows that many materials which appear dry contain moisture.	P I U H	K3	4		6.2.4.3	

4. Chemistry
4.2 States of matter

4.2.2 Liquids

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1. The student knows that a liquid is a state of matter which has a definite volume but has no definite shape.	P I U H	K2 K3	3		2.2.3 5.8.2	
2. The student knows that pure liquids solidify at specific temperatures.	P I U H	K3	3		5.8.2	
3. The student knows that liquids become solid (freeze) when the temperature is sufficiently reduced.	P I U H	K8	4		5.8.2	
4. The student knows that surface tension is a phenomenon attributed to the force of attraction between molecules of a liquid.	P I U H	K2	4		2.2.3 5.8.2	
5. The student knows that the molecules of a substance in the liquid state can escape from the surface of the liquid and move into the gas phase.	P I U H	K3 K4	4		5.8.2	
6. The student knows that the vapor pressure of a substance is the pressure exerted by the gas of that substance when it is in equilibrium with the liquid phase.	U H	K2	4		2.2.3 5.8.2	
7. The student knows that the boiling point of a liquid is the temperature at which the pressure of vapors escaping from the liquid equals the outside pressure.	P I U H	K2	4		5.8.2	

4. Chemistry

4.2 States of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.2 Liquids (Cont.)						
8. The student knows that pure water is a clear, tasteless, odorless liquid which may change when other substances are mixed with it.	P I U H	K3	4		5.8.2 6.3.5.2	

4. Chemistry

4.2 States of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.3 Solids						
1. The student knows that a solid is a state of matter which has a definite volume and a definite shape.	P I U H	K2 K3	3		2.2.3 5.8.2	

4. Chemistry
3.2 States of matter
4.2.3 Solids

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.3.1 Crystal						
1. The student knows that a crystal is a solid in which the pattern of atoms, ions, or molecules forms a characteristic repeating geometric shape.	P I U H	K3	3		5.8.2 6.3.2.4	
2. The student knows that crystals arise by close packing of atoms, ions, or molecules.	I U H	K3 K8	4		5.8.2 6.3.2.4	
3. The student knows that the smallest section of a crystal lattice which can be used to describe its structure is defined as a unit cell.	U H	K1 K2	3		2.2.3 6.3.2.4	
4. The student knows that a single substance can crystallize in two or more forms.	I U H	K3	4		5.8.2 6.3.2.4	
5. The student knows that crystals have definite melting points.	I U H	K3	3		6.3.2.4	
6. The student knows that crystals occur in his or her environment.	P I U H	K6	4		6.3.2.4	
7. The student knows ways of growing crystals.	P I U H	K2	4		6.3.2.4	
8. The student knows that under proper conditions, crystals form when the liquid evaporates from a solution.	P I U H	K3 K6 K8	4		5.8.2 6.3.2.4	

4. Chemistry
4.2 States of matter
4.2.3 Solids

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.2.3.2 Amorphous						
1. The student knows that solids having no well-developed crystal structure are called amorphous.	I U H	K1 K2 K3	3		2.2.3 5.8.2	
2. The student knows that tar and glass are amorphous solids.	I U H	K1 K2	4			
3. The student knows that amorphous substances melt over a wide range of temperatures.	I U H	K3	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3 Solutions						
1. The student knows the location and use of print and nonprint materials related to solutions (e.g., card catalog: "Electrochemistry," "Acids," "Colloids"; SUBJECT GUIDE TO BOOKS IN PRINT: "Solution--Chemistry," "Electrolyte Solutions," "Electrochemistry," "Colloids"; READER'S GUIDE: "Solution--Chemistry," "Acids," "Colloids," "Bases--Chemistry"; LEARNING DIRECTORY: "Solution, Chemical," "Electrolyte," "Acids-Base Chemistry," "Colloid Chemistry"; area and building audiovisual catalogs: "Acids," "Colloids," "Electrochemistry").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resource (V)Inquiry
2. The student knows that a mixture is composed of two or more kinds of molecules.	I U H	K3	3			
3. The student knows that a solution is defined as a homogeneous mixture of the atoms, ions, or molecules of two or more different substances.	I U H	K2	3		2.2.3	
4. The student knows that the dissolved substance in a solution is called the solute and the dissolving medium is called the solvent.	U H	K1 K2	3		2.2.3	
5. The student knows that, because there are three states of matter, there are three possible types of solutions: gaseous solutions, liquid solutions, and solid solutions.	U H	K5	3			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3 Solutions (Cont.)						
6. The student knows that a standard solution is defined as a solution of known concentration.	U H	K2	3		2.2.3	
7. The student knows ways of expressing solution concentration, including percentages by weight and volume, molarity, molality, normality, and mole fraction.	H	K2 K7	3			
8. The student knows that a saturated solution is defined as one which contains the amount of dissolved solute necessary for the existence of an equilibrium between dissolved and undissolved solute.	U H	K2	3		2.2.3	
9. The student knows that a supersaturated solution is defined as one which is more concentrated than a saturated solution.	U H	K2	3		2.2.3	
10. The student knows that a solution is defined as neutral if it contains equal concentrations of hydrogen and hydroxide ions.	H	K2	3		2.2.3	
11. The student knows ways to separate solids from liquids in a mixture (e.g., sedimentation, filtration, distillation, centrifugation).	U H	K7	3		2.2.2.2 5.8.2	
12. The student knows that many common materials are mixtures of two or more different substances.	I U H	K3	4			
13. The student knows that mixtures can be separated.	P I U H	K3	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3 Solutions (Cont.)						
14. The student knows that some materials dissolve in water while other materials do not.	P I U H	K3	4			
15. The student knows that when expressing percentage by weight, the percentage refers to the solute. (A five percent salt solution contains five grams of salt dissolved in ninety-five grams of solvent.)	I U H	K2	3			
16. The student knows that the number of milliliters of solute per one hundred milliliters of solution is defined as the percentage by volume.	U H	K2	3		2.2.3	
17. The student knows that the number of moles of solute per kilogram of solvent is defined as the molality.	H	K2	3		2.2.3	
18. The student knows that the number of equivalent weights of solute per liter of solution is defined as normality.	H	K2	3		2.2.3	
19. The student knows that the fractional part of the total number of moles of solute and solvent due to the solute is the mole fraction of the solute; the fractional part of the whole due to the solvent is the mole fraction of the solvent.	H	K2	3		2.2.3	
20. The student knows that the number of moles of solute per liter of solution is defined as the molarity of the solution.	H	K2	3		2.2.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3 Solutions (Cont.)						
21. The student knows that the freezing point, boiling point, and vapor pressure of a solution differ from those of the pure solvent by amounts which are directly proportional to the molal concentration of the solute molecules or ions.	H	K3 K5 K8	3			

4. Chemistry
4.3 Solutions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.1 Electrolytes						
1. The student knows that electrolytes are present in solution as ions which conduct an electric current.	U H	K3	4		5.1.3.6	
2. The student knows that a salt is defined as any ionic compound, except those in which the hydrogen ion is the positive ion or the hydroxide ion is the negative ion.	U H	K2 K3	3		2.2.3	

4. Chemistry
4.3 Solutions
4.3.1 Electrolytes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.1.1 Acids and bases						
1. The student knows that acids are compounds whose water solutions have a sour taste and cause blue litmus paper to turn red.	I U H	K2	3		2.2.3	
2. The student knows that a base is a water solution of a compound that has a bitter taste, feels slippery when rubbed between the fingers, and turns red litmus paper blue.	I U H	K2	3		2.2.3	
3 The student knows that indicator papers or indicator solutions are used to determine the hydrogen ion concentration or the hydroxide ion concentration of water solutions of acids and bases.	I U H	K3 K9	3		6.3.5.2	
4. The student knows that Arrhenius acids are defined as compounds which dissociate in water to form hydronium ions.	H	K2	3		2.2.3	
5. The student knows that when solutions of Arrhenius acids and bases are mixed, the hydrogen ions from the acid combine with the hydroxide ions from the base to form water, while the other ions present usually do not interfere with this reaction.	H	K3 K8	3 4			
6. The student knows that Arrhenius bases are defined as compounds which dissociate in water to form hydroxide ions.	H	K2	3		2.2.3	

4. Chemistry
4.3 Solutions
4.3.1 Electrolytes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.1.1 Acids and bases (Cont.)						
7. The student knows that Lowry-Bronsted acids are defined as compounds which can act as proton donors.	H	K2 K7	3		2.2.3	
8. The student knows that neutralization is defined as the process of reacting hydronium ions with hydroxide ions.	U H	K2 K7	3		2.2.3	
9. The student knows that Lowry-Bronsted bases are defined as compounds that can act as proton acceptors.	H	K2 K7	3		2.2.3	
10. The student knows that hydronium or hydrogen ions react with carbonates to form carbon dioxide.	U H	K3 K8	4			
11. The student knows that pH is defined as the negative logarithm to the base ten of the molar concentration of hydrogen ions in any solution.	U H	K2	3		2.2.3 6.3.5.2	
12. The student knows that pH is used for convenience of expressing very small concentrations of hydrogen ions.	U H	K7	3		2.2.3 6.3.	
13. The student knows that the dissociation constant for water near room temperature is approximately 1×10^{-14}.	H	K2	4			

4. Chemistry
4.3 Solutions
4.3.1 Electrolytes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.1.2 Electrochemistry						
1. The student knows that spontaneous oxidation-reduction reactions produce a flow of electricity.	H	K3 K8	4			
2. The student knows that some chemical reactions are produced by a flow of electricity.	U H	K3 K8	4			
3. The student knows that producing a chemical reaction by a current of electricity is called electrolysis.	U H	K2 K8	3 4		2.2.3	
4. The student knows that the apparatus and chemicals necessary to produce a spontaneous flow of electricity are collectively called a battery or voltaic cell.	U H	K1 K2	3 4		2.2.2 2.2.3	(C)Electricity (C)Tools
5. The student knows that oxidation (loss of electrons) occurs at the negative electrode (annode) and reduction occurs at the positive electrode (cathode) of a voltaic cell.	H	K3 K6	3			
6. The student knows that electrolysis is the process whereby a current of electricity is used to bring about oxidation-reduction reactions which do not take place spontaneously.	U H	K2	3 4			

4. Chemistry
4.3 Solutions
4.3.1 Electrolytes

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.1.2 Electrochemistry (Cont.)						
7. The student knows that the passage of electricity through a solution of an electrolyte is achieved only by the loss and gain of electrons by the ions in the solution.	U H	K3	3 4			
8. The student knows that the amount of chemical change produced in a solution of ions is directly proportional to the quantity of electricity passed through the solution (Faraday's Law).	H	K3 K8	3 4			
9. The student knows that during electrolysis, or while a voltaic cell is discharging, the passage of one faraday (96,500 coulombs) through the circuit is accompanied by the oxidation of one equivalent weight of matter at one electrode and the reduction of one equivalent weight of matter at the other electrode (Faraday's Law).	H	G1 K1 K3 K8	3			
10. The student knows that when a voltaic cell is completely discharged or run down, the system is at equilibrium.	U H	K3 K6	3 4			

4. Chemistry
4.3 Solutions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.2 Nonelectrolytes						
1. The student knows that a solution of two or more molecules or atoms is called a nonelectrolyte.	U H	K1 K2	3		2.2.3	
2. The student knows that a dissolved nonelectrolyte does not form ions in solution.	U H	K3 K8	4			
3. The student knows that nonelectrolytes will not conduct an electric current.	U H	K3	4			
4. The student knows that a saturated solution is defined as one which contains the amount of dissolved solute necessary for the existence of an equilibrium between dissolved and undissolved solutes.	U H	K2	3		2.2.3	
5. The student knows that solutions of nonvolatile nonelectrolytes show colligative properties.	U H	K3	4			
6. The student knows that the freezing point, boiling point, and vapor pressure of a solution of nonelectrolyte differ from those of the pure solvent by amounts which are directly proportional to the molal concentration of the solute.	U H	K5	3 4			
7. The student knows that colligative properties are boiling point, freezing point, and vapor pressure changes of nonelectrolyte solutions.	U H	K2 K3	3		2.2.3	

4. Chemistry
4.3 Solutions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.3 Colloids						
1. The student knows that matter with a particle size ranging from 10Å to 2000 Å is defined as being in the colloidal state.	H	K2	3		2.2.3	
2. The student knows that practically all substances, whether normally gaseous, liquid, or solid, can be put into the colloidal state.	H	G2 K3 K7	4		5.8.2	
3. The student knows that only one dimension of matter has to be in the colloidal range for the material to be classed as colloidal.	H	K5	3			
4. The student knows that all living tissue is colloidal.	H	K3	4		3.2.1.1	
5. The student knows that similar to solutions, colloidal matter may be scattered or dispersed in a continuous medium to give a colloidal dispersion or colloidal system (e.g., jelly, mayonnaise, India ink, milk, fog).	H	K5 K7	4			
6. The student knows that the Tyndall effect is the scattering of a light beam by colloidal particles.	H	K2 K8	3		5.1.1.1	
7. The student knows that Brownian motion is the random motion of colloidal particles in a dispersing medium.	H	K2	3		5.8.2	

4. Chemistry
4.3 Solutions

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.3.3 Colloids (Cont.)						
8. The student knows that Brownian motion is caused by the unequal number of collisions of dispersing molecules on different sides of the dispersed particle.	H	K8	3 4		5.8.2	
9. The student knows that the movement of charged, dispersed particles in a colloidal system toward the electrode which has the opposite charge is called electrophoresis.	H	K1 K2	3		5.8.2	
10. The student knows that matter in the colloidal state has a tremendous amount of surface (about 1.5 acres for a 1 cm. cube of iron reduced to the colloidal state) and therefore the most important properties are those which are dependent upon surface interactions.	H	K3	4			
11. The student knows that dialysis is the separation of ions from colloids by diffusion through a semipermeable membrane.	H	K2	3		2.2.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.4 Kinetics						
1. The student knows the location and use of print and nonprint materials related to kinetics (e.g., "Dynamics," "Motion"; SUBJECT GUIDE TO BOOKS IN PRINT: "Kinetics, Chemical," "Gases, Kinetic Theory of," "Liquids, Kinetic Theory of"; READER'S GUIDE: "Dynamics," "Plants, Motion of Fluids in"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Gases, Kinetic Theory of"; LEARNING DIRECTORY: "Kinetics, Chemical," "Kinetic Theory"; area and building audiovisual catalogs: "Dynamics," "Motion").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that the rate or speed of a reaction is the change in concentrations of reactants in a unit of time.	U H	K2	3			
3. The student knows that molecules must collide in order to chemically react.	U H	K3 K8	4			
4. The student knows that an increase in temperature will increase the rate of a chemical reaction.	I U H	K3 K8	4			
5. The student knows that an increase in concentration of reactants will increase the rate of a chemical reaction.	I U H	K3 K8	4			
6. The student knows that the rate of a chemical reaction is usually inversely related to the activation energy.	H	G2 K3 K10	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.4 Kinetics (Cont.)						
7. The student knows that the condition of colliding molecules which is necessary for a reaction to occur is called the transition state or activated complex.	H	K1 K3	3		2.2.3	
8. The student knows that the added energy which reacting molecules must have to form the transition state is called the activation energy.	H	K1 K3	3		2.2.3	
9. The student knows that catalysts lower the activation energy for chemical reactions.	U H	K1 K3 K8	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.5 Equilibrium						
1. The student knows the location and use of print and nonprint materials related to equilibrium (e.g., SUBJECT GUIDE TO BOOKS IN PRINT: "Chemical Equilibrium," "Phase Rule and Equilibrium," "Vapor-Liquid Equilibrium"; READER'S GUIDE: "Chemical Equilibrium"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Chemical Equilibrium," "Phase Rule and Equilibrium"; LEARNING DIRECTORY: "Chemical Equilibrium," "Phase Rule," "Phase Equilibrium").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that chemical equilibrium exists when two opposing reactions are proceeding at the same rate.	H	K2 K3 K8	3 4			
3. The student knows that when the products of a specific chemical change, they can react to form the original substances, the reaction is said to be reversible.	U H	K2 K3	3 4			
4. The student knows that in an equilibrium system, a catalyst increases the speed of both forward and reverse reactions to the same extent.	U H	K3 K8	4			
5. The student knows that equilibrium constants remain constant for a given equilibrium system, provided that the temperature is not changed.	H	K3 K5	3 4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.5 Equilibrium (Cont.)						
6. The student knows that a mathematical statement relating the concentrations at equilibrium can be written for equilibrium systems.	H	K2	4			
7. The student knows that if a chemical equilibrium is represented by $aA + bB \rightleftharpoons cC + dD$ then the equilibrium constant (K) is: $K = \frac{[C]^c}{[A]^a} \frac{[D]^d}{[B]^b}$ where c, d, a, and b are the coefficients in the balanced equation and the quantities in the brackets represent moles per liter of A, B, C, and D. There is international agreement that the products on the right of the chemical equation are shown in the numerator and the reactants on the left of the chemical equation are shown in the denominator.	H	K2	3			
8. The student knows that if an equilibrium system is subjected to a change, processes occur which tend to partially counteract the imposed change (LeChatelier's Principle).	H	G2 K3	3 4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.6 Thermochemistry						
1. The student knows the location and use of print and nonprint materials related to thermochemistry (e.g., card catalog: "Combustion--Chemistry," "Distillation," "Chemistry, Physical and Theoretical"; SUBJECT GUIDE TO BOOKS IN PRINT: "Thermochemistry," "Distillation, Fractional," "Gases-Liquefaction"; READER'S GUIDE: "Combustion"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Thermochemistry," "Evaporation," "Thermal Analysis"; LEARNING DIRECTORY: "Thermochemistry," "Evaporation," "Distillation").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that the study of the changes in heat energy of chemical reactions is called thermochemistry.	U H	K2	3		2.2.3	
3. The student knows that calorimeters are devices for measuring the heat changes of chemical reactions.	U H	K2	3		2.2.1.1 2.2.3	(C)Tools
4. The student is able to measure the heat energy released or absorbed in a chemical reaction.	U H	P45	3			
5. The student knows that exothermic chemical reactions are defined as those in which heat energy is released.	U H	K2 K3	3		2.2.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.6 Thermochemistry (Cont.)						
6. The student knows that endothermic chemical reactions are defined as those in which heat energy is absorbed.	U H	K2 K3	3		2.2.3	
7. The student knows that if a given reaction is exothermic, the reverse reaction is endothermic, and the heat absorbed in the endothermic reaction equals the heat liberated in the exothermic reaction.	H	K5	3 4			
8. The student knows that for a given overall reaction, the change in enthalpy is always the same, whether the reaction is performed directly or whether it takes place indirectly and in different steps (Hess' Law).	H	G1 K2	3			
9. The student knows that thermochemical equations can be added or subtracted.	H	K3	3 4			
10. The student knows effects of the physical state of a compound in regard to enthalpy.	H	K8	4			
11. The student knows that enthalpy is defined as the heat content of a substance.	H	K2	3		2.2.3	
12. The student knows that changes in heat content are measured quantities so that the term "change in enthalpy" refers to the heat change during a process carried out at constant pressure and temperature.	H	K2 K3	3		2.2.3	

4. Chemistry

4.6 Thermochemistry (Cont.)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
13. The student knows that atoms of all simple substances have the same capacity for heat (Law of Dulong and Petit).	H	G1 K2	3			
14. The student knows that the measured change in heat energy for a chemical reaction is due to the difference between the heat content of the reactants and products. (There is international agreement that the change in enthalpy shall equal the enthalpy of the products minus the enthalpy of the reactants.)	H	K8	3 4			
15. The student knows that entropy is a measure of the randomness or disorder of a system.	H	K2	3		2.2.3 5.9.7	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.7 Oxidation--Reduction						
1. The student knows the location and use of print and nonprint materials related to oxidation-reduction (e.g., SUBJECT GUIDE TO BOOKS IN PRINT: "Oxidation," "Oxidation-Reduction Reaction," "Reduction, Chemical"; READER'S GUIDE: "Oxidation"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Oxidation," "Spontaneous Combustion," "Antioxidants," "Oxidizing Agents"; LEARNING DIRECTORY: "Oxidation," "Oxidation-Reduction," "Reduction, Oxidation," "Combustion, Chemical"; area and building audiovisual catalogs: "Combustion," "Oxidation-Reduction Reaction").	P I U H	K6	1		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that reduction may be defined as the gain of electrons by atoms, ions, or molecules; the oxidation state of an atom, ion, or molecule becoming less positive; or a chemical reaction in which oxygen is removed from an ion or compound.	U H	K2	3		2.2.3	
3. The student knows that oxidation may be defined as the loss of electrons by atoms, ions, or molecules; the oxidation state of an atom, ion, or molecule becoming more positive; or a chemical reaction in which atoms, ions, or molecules bond to oxygen.	U H	K2	3		2.2.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.7 Oxidation-reduction (Cont.)						
4. The student knows that oxidation and reduction must occur simultaneously.	U H	K6 K8	4			
5. The student knows that some substances are more susceptible to oxidation than are others.	H	K3 K5	4			
6. The student knows that the elements may be arranged in the order of tendency to lose electrons (oxidation) in what is called the activity series or electrochemical series.	H	K3	3 4			
7. The student knows that some substances change in appearance when exposed to the environment.	P I U H	K3 K8	4			(C)Environment (C)Change
8. The student knows that some substances burn while other substances won't burn under the same conditions.	P I U H	K3 K5	4			
9. The student knows that a source of heat energy is needed to start fuels burning.	P I U H	K3 K7	4			
11. The student knows that water solubility of substances changes as the oxidation number of the substance changes.	H	K3 K8	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.8 Spectroscopy						
1. The student knows the location and use of print and nonprint materials related to spectroscopy (e.g., card catalog: "Spectrum"; SUBJECT GUIDE TO BOOKS IN PRINT: "Spectroscopy," "Spectrum Analysis," "Spectrum, Infrared"; READER'S GUIDE: "Spectrum Analysis," "Mass Spectrometry"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Spectroscopy," "Spectrum"; LEARNING DIRECTORY: "Spectroscopy," "Spectroscopy, Ultraviolet," "Spectrum, Absorption").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that spectroscopy is the use of electromagnetic radiation absorption for the structural determination of atoms, ions, or molecules.	H	K2 K3	3		2.2.3	
3. The student knows that atoms, ions, and molecules absorb electromagnetic radiation by excitation to some higher energy level.	H	K3	4			
4. The student knows that color is due to the selective absorption of part of white light by molecules, atoms, or ions.	U H	K8	4			
5. The student knows that chemical bonds may be broken by absorption of electromagnetic radiation.	H	K7 K8	4			

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.9 Nuclear chemistry						
1. The student knows the location and use of print and nonprint materials related to nuclear chemistry (e.g., card catalog: "Chemistry, Physical and Theoretical"; SUBJECT GUIDE TO BOOKS IN PRINT: "Radiochemistry," "Gamma Ray Spectrometry"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Nuclear Reactions"; LEARNING DIRECTORY: "Nuclear Chemistry," "Nuclear Energy"; area and building audiovisual catalogs: "Chemistry, Physical and Theoretical").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that radioactive changes differ from ordinary chemical changes in that the former involve transformations which originate in the nucleus while the latter originate with electrons outside the nucleus.	I U H	K5	4		5.1.6.2	
3. The student knows that an element which undergoes spontaneous emission of radiations is said to be radioactive.	I U H	K2	3 4		2.2.3 5.1.6.2	
4. The student knows that radioactive elements emit radiation which can pass through paper, or even thin sheets of metals, and affect a photographic plate.	I U H	K3	4		5.1.6.2	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.9 Nuclear chemistry (Cont.)						
5. The student knows that isotopes are defined as atoms of a given element which have different masses due to differing numbers of neutrons in the nucleus.	U H	K2	3		2.2.3	
6. The student knows that the term nuclids is a broader and more inclusive term than isotopes and is used to refer to all the different kinds of atoms of all the elements without regard to their atomic numbers or mass numbers.	H	K1 K2	3 4		2.2.3	
7. The student knows that nuclids which are not radioactive are said to be stable.	H	K3 K5	3 4			
8. The student knows that a natural radioactive series is a collection of elements which are formed from a single radioactive element by successive emissions of alpha or beta radiations.	H	K2	3 4		5.1.6.2	
9. The student knows that different elements are formed by alpha and/or beta emissions.	H	K8	4		5.1.6.2	
10. The student knows that when an atom loses a beta particle, the atomic number increases by one but the atomic mass remains the same.	H	K3 K8	3			

4. Chemistry

4.9 Nuclear chemistry (Cont.)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
11. The student knows that when an atom loses an alpha particle, the atomic number decreases by two and the atomic mass decreases by four mass units.	H	K3 K8	3			
12. The student knows that radioactive elements emit radiations including α (helium nucleus), β (electrons), and γ (electromagnetic radiation).	H	K3	4		5.16.2	
13. The student knows that an energy difference exists among the radiations emitted from the nucleus of a radioactive element.	H	K3 K5	4		5.16.2	
14. The student knows that α, β, and γ radiations usually have differen kinetic energies.	H	K3 K5	4		5.16.4	
15. The student knows that different radioactive elements emit α, β, and γ rays with characteristic kinetic energies.	H	K3 K5	3 4		5.16.4	
16. The student knows that the halflife of a radioactive isotope is the time required for one-half of the original isotope to decay (change) to some other isotope.	U H	K2	3 4		2.2.3 5.16.1	
17. The student is able to calculate the half-lives of radioactive elements from measurements of the rate of nuclear disintegration.	H	P35	2 3		2.1.3.5 5.16.2	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.9 Nuclear chemistry (Cont.)						
18. The student knows that binding forces are defined as the forces which operate within the nucleus of an atom.	U H	K2	3		2.2.3	
19. The student knows the meson field theory or model of nuclear binding.	H	K2	3		5.16.3	
20. The student knows that radiation from the nuclei of radioactive atoms can knock electrons out of other atoms, thereby forming ions.	H	K2 K7 K8	4		5.16.2	
21. The student knows that nuclear fusion (the joining of the nuclei of atoms) is accompanied by the conversion of part of the mass into energy (e.g., energy generated in the interior of the sun, the hydrogen bomb).	U H	K2 K8	4		5.16.3	
22. The student knows that nuclear fission (the splitting of nuclei of atoms) is accompanied by the conversion of part of the mass into energy (e.g., nuclear power generator, atomic bomb).	U H	K2 K7 K8	4		5.16.3	
23. The student knows the principles of nuclear reactors.	U H	K3	4		5.16.4	
24. The student knows that nuclear bombardment reactions result when particles of atomic or subatomic size strike atoms of matter causing nuclear changes.	U H	K3 K8	4		5.16.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.9 Nuclear chemistry (Cont.)						
25. The student knows that the rate of nuclear reaction may be used to date the earth, stars, and organic matter.	U H	K3	3 4		5.16.3 6.3.4.4	
26. The student knows that controlled nuclear reactors have been devised for making nuclear energy available for work.	U H	K8	4		5.16.4	
27. The student knows ways in which radioactive elements may be detected.	U H	K7	3		5.16.1	
28. The student knows that in any process, the total mass energy of an isolated system remains unchanged.	H	K3	3 4			(C)Energy

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.10 Photochemistry						
1. The student knows the location and use of print and nonprint materials related to photochemistry (e.g., SUBJECT GUIDE TO BOOKS IN PRINT: "Photochemistry"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Photochemistry," "Phototropy"; READER'S GUIDE: "Photochemistry," "Photosynthesis"; LEARNING DIRECTORY: "Photochemistry," "Photosynthesis"; area and building audiovisual catalogs: "Photosynthesis").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that chemical changes can be caused by light.	I U H	K3 K8	4		5.11.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.11 Organic chemistry						
1. The student knows the location and use of print and nonprint materials related to organic chemistry (e.g., card catalog: "Chemistry, Organic"; SUBJECT GUIDE TO BOOKS IN PRINT: "Chemistry, Organic," "Carbon Compounds," "Chemistry, Physical Organic," "Radicals--Chemistry"; READER'S GUIDE: "Chemistry, Organic," "Cyclic Compounds," "Polymers"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Chemistry, Organic"; LEARNING DIRECTORY: "Organic Chemistry," "Polymer Chemistry"; area and building audio-visual catalogs: "Chemistry, Organic").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that organic chemistry is defined as the chemistry of the compounds of carbon.	U H	K2	3		2.2.3	
3. The student knows that carbon atoms can be bonded to one another to an extent not possible for atoms of any other element.	U H	K3 K5	4			
4. The student knows that carbon atoms can form chains thousands of atoms long, rings of all sizes, and can have branches and crosslinks.	H	K3	4			
5. The student knows that a series of compounds in which each member differs from the next member by a constant number of atoms is called a homologous series.	H	K1 K2	3		2.2.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.11 Organic chemistry (Cont.)						
6. The student knows that the physical and chemical properties of the members of a homologous series will be similar, but vary by a small and constant amount.	H	K3 K5	4			
7. The student knows that atoms or groups of atoms other than carbon and hydrogen bonded to carbon are called functional groups.	H	K2	3		2.2.3	
8. The student knows that the chemical and physical properties of organic compounds are determined by the balance between the functional group present and the number of carbons present.	H	K3 K7	4			
9. The student knows that the functional group present usually determines the physical and chemical properties of the organic compound.	H	K3 K8	4			
10. The student knows that one organic compound may have more than one functional group.	H	K3	K3		4	
11. The student knows that polymers are very large molecules (from hundreds to many hundred thousands of atoms) formed by bonding together many small molecules (called monomers).	H	K2 K8	4		2.2.3	

4. Chemistry

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
4.11 Organic chemistry (Cont.)						
12. The student knows that the chemicals of living systems are the same as those of nonliving systems.	U H	K5	4			(C)Life

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.1 Fundamental physical quantities						
1. The student knows the location and use of print and nonprint materials related to fundamental physical quantities (e.g., card catalog: "Physics," "Time"; SUBJECT GUIDE TO BOOKS IN PRINT: "Physics," "Physics-History," "Mass--Physics," "Time," "Length Measurement"; READER'S GUIDE: "Physics," "Mass--Physics," "Time"; LEARNING DIRECTORY: "Physics," "Mass," "Time"; area and building audiovisual catalogs: "Physics," "Mass--Physics," "Time").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics

5.1 Fundamental physical quantities

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.1.1 Characteristics						
1. The student knows that among the several systems of units of measurement presently in use there is an international trend toward use of the "International Metric System."	I U H	G2 K4	3 4		2.2.1.1	(C)Standardization of criteria (C)Measurement
2. The student knows the system of measurement most commonly used in the United States is the "U. S. Customary System."	H	K1	3 4		2.2.1.1 2.2.3	(C)Measurement
3. The student knows that until recently England used the "British Imperial System" and this system is still used to a limited extent.	H	K1	3 4		2.2.1.1 2.2.3	(C)Measurement
4. The student knows that engineers in the United States usually use forms of U. S. Customary units.	H	K1	3 4		2.2.1.1	(C)Measurement
5. The student knows that the "Gaussian System" (sometimes used in science) is based on the centimeter, gram, and second.	H	K2	3 4		2.2.1.1 2.2.3	(C)Measurement
6. The student knows that a quantity (e.g., velocity, resistance) in physics must provide a set of rules for calculating it in terms of other quantities that can be measured.	H	K2	3 4		2.2.1.1	

5. Physics
5.1 Fundamental physical quantities

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.1.1 Characteristics (Cont.)						
7. The student knows that the set of rules for calculating a quantity is found within the definition of the quantity (e.g., velocity is defined as distance traversed per unit time; velocity is determined by dividing the fundamental unit of distance by the fundamental unit of time).	H	K2	3 4		2.2.1.1	

5. Physics
5.1 Fundamental physical quantities

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.1.2 Mass						
1. The student knows that mass is a fundamental property of matter and is the measure of an object's resistance to change in motion.	P I U H	K2	3 4		2.2.1.1 2.2.3 4.1.1.1 5.1.2	
2. The student is able to compare masses from personal experience (qualitatively).	P I U	P45	2		2.1.4.4 2.1.4.5 2.2.1.1	
3. The student is able to compare masses quantitatively.	I U H	P45	2		2.1.4.5 2.2.1.1	
4. The student knows that in the metric system the basic measurement units of mass are grams and kilograms.	I U H	K1 K2	3 4		2.2.1.1	(C)Measurement
5. The student knows that in the "English" system both "pounds-mass" and "slugs" are used as units of mass.	H	K1 K2	3 4		2.2.1.1	(C)Measurement

5. Physics

5.1 Fundamental physical quantities

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.1.3 Length						
1. The student knows that length is a fundamental physical quantity.	P I U H	K1 K3	3 4			(C)Measurement
2. The student is able to compare distances from personal experience (qualitatively).	P I U H	P45	2		2.1.4.5	(C)Measurement
3. The student is able to measure length.	P I U H	P41	2		2.2.1.1	(C)Measurement
4. The student knows the standard units of linear measurement used in different systems (e.g., Metric--meter, English--foot).	P I U H	K1 K2 K7	3 4		2.2.1.1 2.2.3	(C)Measurement
5. The student is able to compare various lengths quantitatively.	P I U H	P45	2		2.1.4.5	(C)Measurement

5. Physics

5.1 Fundamental physical quantities

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.1.4 Time						
1. The student knows that time is a fundamental quantity.	P I U H	G2 K3	3 4		2.2.1.1	(C)Time
2. The student is able to compare time from personal experience (qualitatively) (e.g., it takes longer to travel around the earth than it does to travel to the next state).	P I U	P45	2		2.1.1.1 2.1.4.5	(C)Measurement (C)Time (C)Perspective
3. The student is able to measure time.	P I U H	P41	2		2.1.4.5	(C)Measurement (C)Time
4. The student knows that time is measured in seconds in both the metric and English systems.	I U H	K2	3 4		2.2.1.1	(C)Measurement (C)Time
5. The student is able to compare intervals of time quantitatively.	P I U H	P45	2		2.1.4.5	(C)Measurement (C)Time

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.2 Vectors and scalars						
1. The student knows the location and use of print and nonprint materials related to vectors and scalars (e.g., card catalog: "Physics"; SUBJECT GUIDE TO BOOKS IN PRINT: "Vector Analysis," "Vector Spaces"; READER'S GUIDE: "Vector Analysis"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Vector Analysis"; LEARNING DIRECTORY: "Scalar Fields," "Vector," "Vector Mathematics").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics

5.2 Vectors and scalars

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.2.1 Characteristics						
1. The student knows that a scalar quantity is a physical quantity involving only one measurement--magnitude (e.g., temperature, mass, time).	U H	K2 K3	3 4		2.2.1.1 2.2.3	(C)Measurement
2. The student knows that a vector is a physical quantity which requires more than one number to completely describe it. (Most common vector quantities can be expressed as a magnitude--one number--and a direction--two numbers.)	U H	K2 K3	3 4		2.2.1.1 2.2.3	(C)Measurement
3. The student knows that a vector can be expressed as sets of components, each component being taken in some different direction (such as N, E, and upward).	U H	K2 K7 K10	3 4		2.2.1.1 2.2.3	(C)Measurement

5. Physics
5.2 Vectors and scalars

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.2.2 Representations						
1. The student knows that a scalar quantity is expressed mathematically as a certain number of measurable units (e.g., 17.3 grams).	U H	K2	3 4		2.2.1.1	(C)Measurement
2. The student knows that a vector can be represented by a straight line with an arrow head on one end.	U H	K2	2 4		2.1.4.1	(C)Measurement (C)Data representation
3. The student knows the arrowhead represents the direction of the vector quantity.	U H	K2	2 4		2.1.4.1	(C)Measurement (C)Data representation
4. The student knows that the length of the shaft of an arrow is a representation of the magnitude of a vector quantity.	U H	K2	2 4		2.1.4.1	(C)Measurement (C)Data representation
5. The student is able to represent scalar and vector measurements.	H	P35 P76	2		2.1.3.5 2.1.7.1	(C)Measurement
6. The student knows that a vector can be a representation of a combination of dimensional components (e.g., an airplane can reach a destination by going northeastward, or it can reach the same point by going north and then east).	H	K2	3 4			(C)Measurement
7. The student is able to resolve a vector into its appropriate components and vice versa.	H	P41 P43 P63	2			(C)Measurement

5. Physics
5.2 Vectors and scalars

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.2.3 Scalar and vector mathematical operations						
1. The student is able to apply mathematical operations to scalar quantities.	H	P63	2 5			
2. The student is able to apply mathematical operations to vector quantities.	H	P63	2 5			
3. The student is able to multiply and divide vector quantities by scalar quantities.	H	P63	2 3			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3 Kinematics (motion)						
1. The student knows the location and use of print and nonprint materials related to kinematics (e.g., card catalog: "Kinematics," "Mechanical Movements," "Mechanics," "Motion"; SUBJECT GUIDE TO BOOKS IN PRINT: "Kinematics," "Hodograph," "Mechanical Movements"; READER'S GUIDE: "Motion"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Kinematics," "Machinery, Kinetics of"; LEARNING DIRECTORY: "Kinematics," "Motion, Physics").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics
5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.1 Characteristics						
1. The student knows that position is always relative to some frame of reference.	P I U H	K2 K6	4		6.1.5	(C)Frame of reference (C)Position
2. The student knows that the changes of position and direction are determined with respect to a specified frame of reference.	I U H	K2 K6	4		6.1.5	(C)Frame of reference (C)Position (C)Direction
3. The student knows that motion is the time rate of change of position.	I U H	K2	3 4		2.2.3 6.1.5	(C)Motion
4. The student knows that all motion is relative.	I U H	K6	4		6.1.5	(C)Motion (C)Perspective
5. The student knows that the rate of change of position can be constant or changing.	I U H	K3	4		6.1.5	(C)Motion
6. The student knows that motion can be in many directions (e.g., rectilinear--straight line, circular, parabolic).	I U H	K3	4		6.1.5	(C)Motion
7. The student knows that an object can undergo a combination of simultaneous motions (e.g., translational, rotational, vibrational).	I U H	K3	4		6.1.5	(C)Motion
8. The student is able to resolve motion into their three-dimensional vector components.	H	P43	2 3		6.1.5	(C)Motion (C)Data representation

5. Physics
5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.1 Characteristics (Cont.)						
9. The student knows that kinematics is the study of motion including speed, velocity, and acceleration.	H	K2	3 4		2.2.3 6.1.5	(C)Motion
10. The student knows the relationship between kinematics and dynamics: kinematics refers to the "how" of motion (speed, velocity, acceleration); dynamics refers to the "why" of the changes in motion (friction, forces, gravity, etc.).	U H	K2 K5	3 4		2.2.3 6.1.5	(C)Motion
11. The student knows that translation is defined as the motion of a body resulting in its movement from one place to another; its geometric center is displaced.	H	K2	4		2.2.3 6.1.5	(C)Motion
12. The student is able to determine the properties of moving objects (e.g., study tracks of rolling spheres).	H	P45	2		2.1.4 6.1.5	(C)Motion
13. The student knows variables which affect moving objects.	H	K8	4		6.1.5	(C)Motion

5. Physics

5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.2 Speed						
1. The student knows that speed is defined as the rate of motion; that is, the amount of change of position during a given amount of time.	I U H	K2	4		2.2.3 6.1.5	(C)Motion (C)Speed
2. The student knows that speed is a scalar quantity.	H	K3	4		6.1.5	(C)Motion (C)Speed
3. The student is able to determine the average speed of objects in a physical situation.	U H	P35	2 5		6.1.5	(C)Motion (C)Speed
4. The student is able to compare speeds according to his own experience (e.g., one car is traveling faster than another).	P I U H	P45	2 5		6.1.5	(C)Motion (C)Speed

5. Physics
5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.3 Rectilinear velocity (straight-line velocity)						
1. The student knows that velocity is defined in terms of both speed and direction.	U H	K2	3 4		2.2.3 6.1.5	(C)Motion
2. The student knows that velocity is defined as the vector change of position.	H	K2	3 4		2.2.3 6.1.5	(C)Motion
3. The student knows the difference between speed and velocity.	U H	K5	3 4		6.1.5	(C)Motion (C)Discrimination
4. The student is able to determine the velocity of moving objects by determining speed and direction.	H	P35 P63	2		6.1.5	(C)Motion (C)Measurement
5. The student knows that velocity is a vector quantity.	H	K3	3 4		2.2.3 6.1.5	(C)Motion
6. The student knows that average velocity is determined by dividing the total displacement by the elapsed time.	H	K2	3 4		6.1.5	(C)Motion (C)Measurement
7. The student knows that instantaneous velocity is expressed as $v = \underset{\Delta t \to 0}{\text{limit}} \frac{\Delta x}{\Delta t}$, where Δ means "a change in."	H	K2	3 4		6.1.5	(C)Motion (C)Measurement
8. The student is able to graph displacement as a function of time.	H	P35 P76	2 3		6.1.5	(C)Motion (C)Time

5. Physics

5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.3 Rectilinear velocity (straight-line velocity) (Cont.)						
9. The student is able to interpret information from a displacement versus time graph.	H	P43	2 3			(C)Data interpretation
10. The student is able to compare velocities from personal experience (qualitatively).	P I U H	P45	2		6.1.5	(C)Motion (C)Measurement

5. Physics

5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.4 Rectilinear acceleration (straight-line acceleration)						
1. The student knows that acceleration is defined as the amount of change of velocity (magnitudinal or directional) per unit time.	I U H	K2	3 4		2.2.3 6.1.5	(C)Motion
2. The student knows that a changing velocity is either an acceleration or a deceleration.	I U H	K3	4		6.1.5	(C)Motion
3. The student knows that acceleration is a vector quantity.	H	K3	4		6.1.5	(C)Motion
4. The student knows that average acceleration is computed by dividing the change in velocity by the elapsed time.	U H	K2	4		6.1.5	(C)Motion
5. The student knows that instantaneous acceleration is expressed as $a = \underset{\Delta t \to 0}{\text{limit}} \frac{\Delta v}{\Delta t}$.	H	K2	4		6.1.5	(C)Motion
6. The student is able to determine the average acceleration of objects in a physical situation.	U H	P63	2 3		2.1.4.5 6.1.5	(C)Motion (C)Measurement
7. The student is able to graph velocity as a function of time.	H	P35 P76	2 3		2.1.5.2 6.1.5	(C)Motion
8. The student is able to interpret information from a velocity versus time graph.	H	P41	2		2.1.5.2 6.1.5	(C)Data interpretation

5. Physics
5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.4 Rectilinear acceleration (straight-line acceleration) (Cont.)						
9. The student is able to compare acceleration from personal experience (qualitatively).	H	P45	2		2.1.4.5	(C)Motion (C)Measurement

5. Physics
5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.5 Trajectory motion						
1. The student knows that trajectory motion is two dimensional motion influenced by the force of gravity (e.g., flight of baseball, football, tennis ball, rocket).	H	K3	2 3		2.2.3 6.1.5	(C)Motion
2. The student knows that trajectory motion can be resolved into rectilinear components of the two separate dimensions.	H	K3	2 3		6.1.5	(C)Motion
3. The student is able to relate the definitions and equations for rectilinear motion to the components of the trajectory motion.	H	P44	2		2.1.4.4 6.1.5	(C)Motion

5. Physics

5.3 Kinematics (motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.3.6 Circular motion						
1. The student knows that an object can travel at a constant speed along a curved path of constant radius (e.g., the end of the second hand on a clock).	I U H	K3	4		6.1.5	(C)Motion
2. The student knows that an object moving at constant speed along a curved path of constant radius is uniformly accelerating because the direction of travel is constantly changing.	U H	G2 K3 K8	4		6.1.5	(C)Motion
3. The student knows that circular acceleration is called centripetal acceleration because it is directed toward the center.	U H	K2	4		2.2.3 6.1.5	(C)Motion
4. The student knows that the basic definitions and equations for speed, velocity, and acceleration apply to circular motion.	U H	K2 K7	4		6.1.5	(C)Motion
5. The student is able to determine speed, velocity, or acceleration of objects in circular motion.	U H	P35 P63	2 3		2.1.4.5 6.1.5	(C)Motion
6. The student knows that rotation is defined as the motion of a rigid body in such a manner that all its particles move in circles about a common axis.	U H	K2	3 4		2.2.3 6.1.5	(C)Motion

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4 Dynamics (causes of motion)						
1. The student knows the location and use of print and nonprint materials related to dynamics (e.g., card catalog: "Dynamics," "Force and Energy," "Gravitation"; SUBJECT GUIDE TO BOOKS IN PRINT: "Dynamics," "Hydrodynamics," "Friction," "Gravitation"; READER'S GUIDE: "Dynamics," "Force and Energy," "Gravitation"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Dynamics," "Aerodynamics," "Friction, Internal"; LEARNING DIRECTORY: "Dynamics"; area and building audiovisual catalogs: "Dynamics," "Force and Energy," "Aerodynamics").	P I U H	K6	3		2.1.1.2	(C)Resources (V)Inquiry

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.1 Characteristics						
1. The student is able to predict the effects of force upon an object.	P I U H	P51	2		2.1.5.1 6.1.5	(C)Motion (C)Force
2. The student knows the ways in which characteristics of forces relate to changes in motion.	I U H	K8	4		6.1.5	(C)Motion (C)Force
3. The student knows that dynamics is a study of the relationship between forces and motion.	U H	K2	3 2		2.2.3 6.1.5	(C)Motion

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.2 Forces						
1. The student knows that a force is any push or pull.	P I U H	K2	3 4		2.2.3 6.1.5	(C)Motion (C)Force
2. The student knows that forces are vector quantities.	H	K2	2		2.2.3 6.1.5	(C)Motion (C)Force
3. The student knows various types of forces (e.g., frictional, gravitational, nuclear, atomic, molecular, electrical, hydrostatic, fluid).	P I U H	K1 K5	4		6.1.5	(C)Force
4. The student knows the four fundamental forces--gravitational, electromagnetic, and two kinds of nuclear forces.	P I U H	K1 K5	4		6.1.5	(C)Force
5. The student knows commonly used units of force (e.g., pound, newton, dyne).	U H	K1	4			
6. The student knows that an object is defined to be in equilibrium if the result of the vector of all the forces acting upon the object is zero.	U H	K2 K8	3 4		2.2.3 6.1.5	(C)Force
7. The student knows that an unbalanced force exists when the vector sum of all the forces acting upon an object is not zero (not in equilibrium).	U H	K2 K8	3 4		6.1.5	(C)Force
8. The student knows that there can be many forces acting on an object from many different directions.	I U H	G2 K2	4		6.1.5	(C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.2 Forces (Cont.)						
9. The student knows ways in which the forces may be applied to objects.	P I U H	K3 K7	4		6.1.5	(C)Force
10. The student knows that several forces acting on an object (acting through a common point--concurrent) can be resolved into a single force acting on that point.	U H	K2 K7	4		6.1.5	(C)Force
11. The student is able to resolve all the concurrent forces acting on an object into one force acting at a specific point.	H	P43	2		6.1.5	(C)Force
12. The student knows that if a state of equilibrium exists, an object at rest will remain at rest, and an object in motion will maintain a constant velocity.	U H	G2 K3	4		6.1.5	(C)Force
13. The student knows that tendency to maintain a state of motion is known as inertia (Newton's First Law).	U H	G1 K2	3 4		2.2.3 6.1.5	(C)Motion
14. The student knows that an object will accelerate in the direction in which an unbalanced force acts upon it. (The acceleration is directly proportional to the magnitude of the unbalanced force and inversely proportional to the mass of the object--Newton's Second Law).	H	G1 K2 K8	4		6.1.5	(C)Motion (C)Force
15. The student knows the mathematical relationship between force, mass, and acceleration (F=ma).	U H	K2 K7	3 4		6.1.5	(C)Motion (C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.2 Forces (Cont.)						
16. The student knows relationships between units of force, mass, and acceleration. $\left(\begin{array}{l} 1 \text{ newton} = 1 \text{ kilogram} \times 1 \text{ meter/second}^2 \\ 1 \text{ dyne} = 1 \text{ gram} \times 1 \dfrac{\text{centimeter}}{\text{second}^2} \\ 1 \text{ pound} = 1 \text{ slug} \times 1 \text{ foot/second}^2 \end{array}\right)$	H	K2 K7	3 4		6.1.5	(C)Motion
17. The student knows that for every force there is an equal and opposite force (the pair of forces are a single reaction--Newton's Third Law).	I U H	G1 K2	3 4		6.1.5	(C)Motion (C)Force
18. The student knows that a force is necessary to either start an object moving, keep it moving, turn it, slow it down, or stop it when it is in motion.	I U H	G2 K3 K8	3 4		6.1.5	(C)Motion (C)Force
19. The student knows that spring instruments can be devised to measure force.	I U H	K7	4		2.2.2.2	(C)Motion (C)Force (C)Measurement
20. The student is able to compare forces from personal experience (qualitatively).	P I U H	P45	2		2.1.4.5	(C)Motion (C)Force
21. The student is able to compare forces quantitatively.	P I U H	P45	2		2.1.4.5	(C)Motion (C)Force
22. The student knows variables which affect the amount of energy transferred to a moving object.	U H	K8	4			(C)Motion (C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.3 Friction						
1. The student knows that friction is the force which opposes motion caused by one object's surface moving in contact with another object's surface.	P I U H	K2	4		2.2.3	(C)Motion (C)Force
2. The student knows causes of friction.	P I U H	K8	4			(C)Motion (C)Force
3. The student knows that frictional forces are dependent upon the properties of the materials involved (e.g., temperature, velocity, area, type of motion, weight).	P I U H	K3 K6	4			(C)Motion (C)Force
4. The student knows ways to determine forces of friction.	U H	K2 K7	3 4			(C)Motion (C)Force
5. The student knows ways to increase or decrease the frictional forces between materials.	I U H	K7	3 4			(C)Motion (C)Force
6. The student knows the helpful and detrimental effects of friction in his or her environment.	P I U H	K8	4 5			(C)Motion (C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.4 Gravity						
1. The student knows Newton's Law of Gravitation. (All bodies in the universe attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers. $F = G \frac{m_1 m_2}{R_2}$).	I U H	G1 K2	4		2.2.3 6.1.5 6.3.2.1.2	(C)Motion
2. The student is able to calculate the gravitational force of attraction between two objects.	H	P35 P63	2		6.3.2.1.2	(C)Motion
3. The student knows that gravity is defined as a force of attraction between objects due to their mass.	I U H	K2	3 4		2.2.3 6.1.5	(C)Motion
4. The student knows the weight of an object is defined as the gravitational force exerted on the object by an astronomical body, such as the earth.	I U H	K2	3 4		2.2.3 6.1.5 6.3.2.1.2	(C)Weight (C)Force
5. The student knows that objects allowed to fall freely (with only gravity exerting a force) from the same point toward the surface of the earth will accelerate at the same rate.	I U H	G2 K3	4		6.3.2.1.2	(C)Motion (C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.4 Gravity (Cont.)						
6. The student knows that the acceleration due to gravity at any position above the earth is dependent upon the distance from the earth's center, the average density of the earth below, and the earth's rotation.	U H	K8	4		6.1.5	(C)Force (C)Motion
7. The student is able to compare weights of objects by weighing them in his or her hands (qualitative comparison).	P I U H	P45	2		2.1.4.5	(C)Weight
8. The student is able to compare weights of objects by weighing them on a scale (quantitative comparison).	P I U H	P45	2	5	2.1.4.5	(C)Weight (C)Measurement
9. The student is able to predict the variations in the weight of an object as measured at different distances from the center of the earth.	I U H	P51	2		2.1.5.1	(C)Weight (C)Change
10. The student knows ways in which acceleration due to the gravity of an object may be determined.	U H	K2 K7	2			(C)Motion (C)Measurement
11. The student knows the accepted "working" values for acceleration due to gravity near the earth's surface (e.g., 32.2 feet per second squared, and 980 centimeters per second squared are accepted "working" values for the acceleration due to gravity near the earth's surface).	H	K2	4		6.1.5	(C)Motion (C)Measurement

5. Physics

5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.4 Gravity (Cont.)						
12. The student knows the center of gravity is the point at which all the weight of a body may be considered to be concentrated.	U H	K2	4		6.1.5	(C)Weight
13. The student knows the center of mass is the point at which all the mass of a body may be considered to be concentrated.	U H	K2	4		4.1.1.1 5.1.2	(C)Mass

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.5 Moment of a Force						
1. The student knows that forces can act on a body in parallel directions (e.g., two children on a teeter-totter and the fulcrum form several pairs of parallel forces.	U H	K3 K6 K8	4		6.1.5	(C)Motion (C)Force
2. The student knows the perpendicular distance from a reference point to the line of action of the force is called the force arm.	H	K2	4		2.2.3 6.1.5	(C)Force
3. The student knows that the rotational effect on an object, because of force, is directly proportional to the length of the force arm from the pivot point.	H	K8	4		6.1.5	(C)Force
4. The student knows the product of the magnitude of a force and its force arm is called the moment of the force, or the torque.	H	K2	4		2.2.3 6.1.5	(C)Force
5. The student is able to determine the center of gravity of an object.	U H	P35	2		6.1.5 6.3.2.1.2	(C)Force
6. The student knows that a couple is two forces of equal magnitude acting in opposite directions but not acting at the same point.	H	K2 K8	3 4		2.2.3 6.1.5	(C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.6 Impulse and momentum						
1. The student knows that impulse (I) is defined as the product of force (F) and time (t) where the force is the resultant constant force applied to an object and time is the interval of time for which it is applied ($I = F \cdot t$).	H	K2	4		2.2.3	(C)Data representation
2. The student knows that momentum (P) is defined as the product of mass (m) and velocity (v) when mass is the mass of the object and velocity is the velocity at which it is moving ($p = m \cdot v$).	H	K2	4		2.2.3	(C)Data representation
3. The student knows that impulse and momentum are both vector quantities.	H	K3	4		5.2.1	(C)Measurement
4. The student knows that the impulse applied to a body is equal to the change in momentum of the body.	H	K2 K8	4			(C)Measurement
5. The student knows that in an isolated system the total momentum always remains constant (momentum is conserved).	H	K2	4			(C)Measurement
6. The student knows that, in a given amount of time, more force has to be applied to stop a large mass than to stop a small mass if both masses were moving at the same speed originally.	I U H	K3 K8	4			(C)Force

5. Physics
5.4 Dynamics (causes of motion)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.4.6 Impulse and momentum (Cont.)						
7. The student knows that to get two masses, one larger than the other, moving at the same speed in the same amount of time, more force must be applied to the larger mass.	I U H	K3 K8	4			(C)Force
8. The student knows that the same change in momentum of a body can be produced by any number of combinations of force and time (i.e., a small force applied for a long interval of time can produce the same effect as a large force applied for small amount of time).	H	K3 K8	4			(C)Motion (C)Change
9. The student knows that the concepts of impulse and momentum can be applied to rotational motion.	H	K7	4		6.1.5	(C)Motion
10. The student knows that the angular momentum of an object remains constant unless a torque acts on the object.	H	K3 K8	4		6.1.5	(C)Motion
11. The student knows that as the mass of a rotating object shifts, the angular velocity of the object also changes so that angular momentum will be conserved.	H	K8	4		6.1.5	(C)Motion
12. The student knows applications of concepts of conversation of angular momentum (e.g., riding a bicycle, gyroscope, electron spin, a top).	H	K7	5		6.1.5	(C)Motion

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.5 Mechanical energy						
1. The student knows the location and use of print and nonprint materials related to mechanical energy (e.g., card catalog: "Force and Energy," "Dynamics"; SUBJECT GUIDE TO BOOKS IN PRINT: "Energy," "Kinetics," "Force and Energy"; READER'S GUIDE: "Force and Energy," "Horsepower--Mechanics"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Work," "Force and Energy," "Centrifugal Force," "Surface Energy"; LEARNING DIRECTORY: "Mechanical Energy," "Work, Energy," "Conservation, Energy, Physics"; area and building audiovisual catalogs: "Force and Energy").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics
5.5 Mechanical energy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.5.1 Characteristics						
1. The student knows that there are many forms of energy (e.g., thermal, electromagnetic, electrical, mechanical, nuclear, atomic, chemical).	I U H	K3 K5	4		4.6 5.1.3.8 5.1.6.4 6.3.2.1.5	(C)Energy
2. The student knows that energy is defined as the ability to do work.	I U H	K2	3 4		2.2.3 4.6 5.1.3.8 5.1.6.4 6.3.2.1.5	(C)Energy
3. The student knows that energy can be transformed from one form to another.	I U H	K3 K4	4		4.6 5.1.3.8 5.1.6.4 6.3.2.1.5	(C)Energy
4. The student knows some units of energy (e.g., joules, ergs, calories).	U H	K1	3		4.6 5.1.3.8 5.1.6.4 6.3.2.1.5	
5. The student knows ways in which the various units of energy are interrelated.	U H	K8	4		4.6 5.1.3.8 5.1.6.4 6.3.2.1.5	(C)Energy
6. The student is able to use the equations defining the forms of energy in situational problems.	H	P35 P44	5		2.2.5	(C)Energy
7. The student is able to account for the various energy forms in a physical situation.	U H	P44 P63	5		2.1.7.1	(C)Energy
8. The student knows that energy is a scalar quantity.	H	K3	4		5.2	(C)Energy (C)Measurement

5. Physics

5.5 Mechanical energy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.5.2 Work						
1. The student knows that there is an exchange of energy when work is done on an object.	I U H	K8	4		4.6 5.5.2	(C)Energy
2. The student knows that work is involved only if two systems interact.	I U H	K6 K8	4		5.5.2	(C)Energy
3. The student knows that work done on an object is defined as the product of the applied force (F) and the distance moved (d). The direction of motion must be the same as the direction of the imparted force. ($w = F \times d$).	I U H	K2	3 4		5.5.2	(C)Energy
4. The student knows that work is a scalar quantity.	H	K3	4		5.5.2	(C)Energy
5. The student knows that work has units of energy (e.g., joules, ergs, foot-pounds).	I U H	K2	3		2.2.1.1	(C)Energy
6. The student is able to determine the amount of work done in a physical situation.	U H	P35 P63	2 5		5.5.2	(C)Energy
7. The student knows that power is defined as the rate at which work is done; power equals the work done divided by the length of time required to do the work ($P = \frac{w}{t}$).	H	K2	3 4		2.2.3	(C)Energy (C)Measurement
8. The student knows common units for power and the relationship between them.	H	K1 K3	3			(C)Data representation

5. Physics
5.5 Mechanical energy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.5.3 Kinetic energy						
1. The student knows that kinetic energy is the energy that an object has because of its motion.	I U H	K2	3 4		2.2.3	(C)Motion (C)Energy
2. The student knows that if an object has no motion it has no kinetic energy.	I U H	K3	4			(C)Motion (C)Energy
3. The student knows that kinetic energy of an object is directly proportional to the mass of the object and directly proportional to the square of the velocity of the object ($E = \frac{1}{2}mv^2$).	H	K2 K8	4			(C)Energy
4. The student knows that kinetic energy is a scalar quantity.	H	K3	3 4			(C)Energy
5. The student knows ways to determine the kinetic energy of objects	U H	K2 K7	5			(C)Energy
6. The student knows that kinetic energy is a quantity which is the property of a single system.	U H	K3	4			(C)Energy
7. The student knows that work must be done for an object to gain kinetic energy or to cause the object to lose kinetic energy.	U H	K8	4		5.5.2	(C)Energy

5. Physics
5.5 Mechanical energy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.5.4 Potential energy						
1. The student knows that potential energy is stored energy which can be used to do work because it is in a certain position or condition (e.g., winding a coiled spring stores mechanical energy to run a machine; a log stores energy that can later be released as heat and light).	I U H	K2	3 4		2.2.3	(C)Energy
2. The student knows that work must be done or heat must be added in order to store energy.	I U H	K3 K8	4		5.5.2	(C)Energy
3. The student knows that there are many forms of potential energy (e.g., energy in a compressed spring, electrical potential energy, chemical potential energy).	I U H	K3 K5	3 4			(C)Energy
4. The student knows that potential energy, like work, is a quantity that can result only if two separate systems interact.	U H	K3 K8	3 4		5.5.2	(C)Energy
5. The student knows that potential energy is a scalar quantity.	H	K3	3 4		5.2.1	(C)Energy
6. The student is able to determine the potential energy of objects.	H	P35 P63	2 3		2.1.4.5	(C)Energy
7. The student knows the equations for various forms of potential energy (e.g., gravitational, elastic).	H	K2	3		2.2.5	(C)Energy

5. Physics
5.5 Mechanical energy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.5.5 Conservation of energy						
1. The student knows that there may be more than one form of energy or matter resulting from a change of energy (e.g., an incandescent light bulb uses electrical energy to produce both light and heat energy).	P I U H	K3 K8	4			(C)Energy
2. The student is able to calculate the energies of a falling object as the object is falling; calculate the loss of gravitational potential energy and the gain of kinetic energy; and account for the energy that is dissipated by friction.	H	P35	2		2.1.4.5	(C)Energy
3. The student knows the relationships between potential energy, kinetic energy, and total energy.	U H	K8	4		5.5.3 5.5.4	(C)Energy
4. The student knows that in a system the total mass and energy are conserved.	U H	G2 K2	4			(C)Energy (C)System
5. The student knows that as an object's velocity increases, so does its mass. (This increase in mass being another manifestation of the increase in kinetic energy, the mass increase is usually noticeable only when the velocity is an appreciable fraction of the speed of light.)	U H	G1 K8	4			(C)Energy

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.6 Machines						
1. The student knows the location and use of print and nonprint materials related to machines (e.g., card catalog: "Machinery"; SUBJECT GUIDE TO BOOKS IN PRINT: "Machinery," "Levers"; READER'S GUIDE: "Machinery"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Machinery"; LEARNING DIRECTORY: "Machine, Simple," "Lever," "Balance"; area and building audiovisual catalogs: "Machinery").	P I U H	K6	1		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics
5.6 Machines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.6.1 Characteristics						
1. The student knows that a simple machine performs only one function.	P I U H	K7	4			(C)Machines
2. The student knows that a compound machine is made of two or more simple machines.	P I U H	K3	4		2.2.3	(C)Machines
3. The student knows that simple machines transform energy, transfer energy, multiply force, multiply seed, or change the direction of a force.	I U H	K7	4			(C)Machines
4. The student knows that the theoretical mechanical-advantage of a machine (MA) is equal to the distance moved by the force applied to a machine (dF) divided by the distance that the resistance (dR) was moved (by the force).	H	K2	4			(C)Machines (C)Data Representation (C)Measurement
5. The student knows that the actual mechanical advantage of a machine is equal to the work done with the machine (R x d) divided by the work done on the machine (F x d).	H	K2	4			(C)Machines (C)Measurement (C)Data Representation
6. The student is able to determine the mechanical advantage of a simple machine.	H	P35	2			(C)Machines (C)Measurement
7. The student is able to calculate the theoretical and actual mechanical advantages of machines.	H	P35	2			(C)Machines (C)Measurement

5. Physics
5.6 Machines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.6.2 Simple machines						
1. The student knows the classes of simple machines (e.g., inclined plane, lever, wheel and axle, pulley, screw, wedge).	P I U H	K5	4			(C)Machines
2. The student knows the ways in which the principle of the lever is applied in other simple machines (e.g., pulley, wheel and axle).	P I U H	K7	5			(C)Machines
3. The student knows the ways in which the principle of the inclined plane is applied in other simple machines (e.g., wedge, screw).	P I U H	K7	5			(C)Machines
4. The student knows which of the simple machines is most appropriate to use in order to accomplish a particular task.	P I U H	K7	5			(C)Machines
5. The student knows the advantage of using simple machines to do work.	P I U H	K8	4		5.5.2	(C)Machines
6. The student is able to use a simple machine to do work.	P I U H	P63	2		2.2.2 5.5.2	(C)Machines
7. The student is able to control a simple but unfamiliar mechanical system.	P I U H	P35	2		2.2.2	(C)Machines

5. Physics
5.6 Machines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.6.3 Levers and balances						
1. The student knows that a lever is a rigid bar that turns around a point or axis when a force is applied.	P I U H	K2 K7	4		2.2.3	(C)Machines
2. The student knows that fulcrum is defined as the point or axis about which a lever turns.	I U H	K1 K2	3 4		2.2.3	(C)Machines
3. The student knows the types of levers.	P I U H	K1 K5	4			(C)Machines
4. The student is able to use appropriate levers with respect to specified tasks.	P I U H	P63	2 5			(C)Machines
5. The student knows the advantage to be gained by selecting a particular class of lever to accomplish a task.	P I U H	K8	4 5			(C)Machines
6. The student knows that the force which is applied to a lever is called the force (F), the object to be moved is called the resistance (R), and the pivot point is called the fulcrum (f).	I U H	K1	4			(C)Machines
7. The student knows that objects may be balanced on opposite sides of a lever arm by changing their distances from the fulcrum (e.g., on a teeter-totter the fulcrum and/or the objects may be moved).	P I U H	G2 K8	4			(C)Machines

5. Physics
5.6 Machines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.6.3 Levers and balances (Cont.)						
8. The student knows that the distance an object is moved times its gravitational force on one end of the lever arm is equal to the force applied at the opposite end times the distance it moves.	P I U H	K2	4			(C)Machines
9. The student knows that in a balanced lever situation the weight of the object on one end times its distance from the fulcrum is equal to the weight of the object on the opposite end times its distance from the fulcrum.	P I U H	K2	4			(C)Machines
10. The student knows that an equal arm balance can be used to compare the known gravitational attraction of another object on the opposite end.	I U H	K7	3 4			(C)Machines (C)Tools
11. The student knows that a balance is an instrument for comparing masses.	P I U H	K7	3		2.2.2.2	(C)Machines (C)Tools
12. The student is able to compare masses with a balance.	P I U H	P45	2 3		2.1.4.5 2.2.2.2	(C)Mass
13. The student knows that prior to using a balance, the balance arms should come to rest in balance before anything is added to either side.	P I U H	K7	3			(C)Machines (C)Tools
14. The student is able to balance objects on opposite ends of a fulcrum.	P I U H	P35	2		2.1.3.5	(C)Machines

5. Physics
5.6 Machines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.6.3 Levers and balances (Cont.)						
15. The student knows the relationship between the masses of objects and their distance from the fulcrum when balancing an equal arm balance.	P I U H	K8	4			(C)Machines
16. The student knows that a reason for using a set of standardized masses of different units (kilograms, grams) enables smaller units of measure to be used when finding unknown masses.	I U H	K7	3 4			(C)Mass (C)Measurement
17. The student knows the relationship between the size and the turning rate of interacting pulleys.	I U H	K8	3 4			(C)Machines (C)Tools

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.7 Frames of reference						
1. The student knows the location and use of print and nonprint materials related to frames of reference (e.g., card catalog: "Motion," "Force and Energy," "Quantum Theory"; SUBJECT GUIDE TO BOOKS IN PRINT: "Measure Theory," "Coordinates," "Gravitation"; READER'S GUIDE: "Relativity," "Force and Energy," "Time Measurement"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Physical Measurements," "Space and Time," "Inertia," "Mass"; McGRAW-HILL ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY: "Frames of Reference," "Inertial Reference Frames," "Symmetry Laws--Physics," "Newtonian Reference Frames"; LEARNING DIRECTORY: "Equivalent," "Gravity, Law," "Einstein, Relativity Theory"; area and building audiovisual catalogs: "Gravitation," "Matter," "Light," "Relativity--Physics").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

5. Physics
5.7 Frames of reference

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.7.1 Characteristics						
1. The student is able to select and use reference objects in the immediate environment to describe the relative position of other objects.	P I U H	P33	2 5		2.1.3.3 2.1.4.3	(C)Frame of reference
2. The student is able to use basic directions (above, below, right, left, front, back) when describing relative position.	P	P74 P75	2 3			(C)Frame of reference
3. The student is able to relate the motion or lack of motion of an object in different frames of reference.	P I U H	P44	2		2.1.4.4	(C)Frame of reference (C)Motion
4. The student knows that change of relative position is evidence of relative motion.	P I U	K10	4			(C)Change physical (C)Motion
5. The student knows ways in which relative motion can be illustrated (e.g., motion pictures, flip books).	P I U H	K7	5 8			(C)Motion
6. The student knows that a frame of reference is a three-dimensional coordinate system from which measurements are made (e.g., the corner of the room).	P I U H	K2	3 4		2.2.3	(C)Frame of reference (C)Measurement
7. The student is able to locate objects using rectangular coordinates.	I U H	P44	2			(C)Frame of reference (C)Perspective
8. The student is able to locate objects using polar coordinates.	I U H	P44	2		2.2.5	(C)Frame of reference (C) Location

5. Physics
5.7 Frames of reference

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.7.1 Characteristics (Cont.)						
9. The student is able to measure polar coordinates of objects in the environment.	I U H	P44	2 5		2.2.1.1	(C)Frame of reference (C)Measurement
10. The student is able to express directions in degrees.	I U H	P35 P44	2		6.1.4.1	(C)Frame of reference
11. The student knows that measurements of the same physical quantity may differ when made in different frames of reference.	I U H	K5 K6	4			(C)Frame of reference (C)Measurement
12. The student knows that most physical laws are the same in all frames of reference.	U H	K3 K5	4			(C)Frame of reference
13. The student knows that there is one value for the speed of light in a vacuum and it is the same in all frames of reference.	U H	G1 K2	4			(C)Frame of reference
14. The student knows that accelerated frames of reference introduce fictitious forces arising when a system undergoes circular motion.	H	G2 K3 K8	4		5.3.6	(C)Frame of reference (C)Motion
15. The student knows that in a closed system there is no way to distinguish the effects of a gravitational field at a point from those of acceleration of the system (the principle of equivalence).	H	G1 K2	4			(C)Frame of reference (C)System

5. Physics
5.7 Frames of reference

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.7.2 Relative quantities						
1. The student knows that the measurement of time is relative and is dependent upon the frame of reference.	P I U H	G1 K3 K8	4		2.2.1.1 6.1.5	(C)Frame of reference (C)Time (C)Measurement
2. The student knows ways to relate time intervals between two events.	P I U H	K10	3 4		2.2.1.1 6.1.5	(C)Time
3. The student knows the time interval between two events may be different if measured by two observers, one at rest and one moving with respect to the event.	H	K5 K6	4		6.1.5	(C)Time (C)Measurement
4. The student knows the equations for relating the time intervals of two events as observed from two different frames of reference.	H	K2	3		2.2.5 6.1.5	(C)Time (C)Data representation (C)Frame of reference
5. The student knows that the measurement of length is relative and is dependent upon the frame of reference in which it is made.	I U H	G1 K3 K8	4		2.2.1.1	(C)Measurement (C)Frame of reference
6. The student knows that the length measurement between two frames of reference may be different if measured by two observers, one at rest and one moving with respect to the event.	H	K5 K6	4		2.2.1.1	(C)Measurement (C)Frame of reference
7. The student knows the equation for relating length measurements between two frames of reference, one fixed and one moving.	H	K2 K6	3			(C)Data representation (C)Frame of reference

5. Physics

5.7 Frames of reference

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.7.2 Relative quantities (Cont.)						
8. The student knows that determination of velocity is relative and is dependent upon the frame of reference in which it is determined.	U H	G1 K3 K8	4			(C)Frame of reference
9. The student knows equations for relating velocities as determined from different frames of reference.	H	K2 K6	3			(C)Frame of reference
10. The student knows that the measurement of mass is relative and is dependent upon the frame of reference.	U H	G1 K3 K8	4			(C)Measurement (C)Frame of reference
11. The student knows equations for relating mass differences as measured by two observers, one at rest and one moving with respect to the matter.	H	K2 K6	3			(C)Mass
12. The student knows that mass and energy are different ways we perceive the same thing.	U H	G1 K6	4			(C)Mass (C)Energy
13. The student knows that if the energy of something increases, so must the mass.	U H	K8	4			(C)Mass (C)Energy
14. The student knows that rest mass (m_o) of an object is itself "entrapped" energy given by $E_o = m_oc^2$ where c is the speed of light.	H	G1 K2	4			(C)Mass (C)Energy

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8 Properties of matter						
1. The student knows the location and use of print and nonprint materials related to properties of matter (e.g., card catalog: "Matter," "Liquids," "Hydrodynamics," "Hydraulics," "Hydrostatics"; SUBJECT GUIDE TO BOOKS IN PRINT: "Matter--Constitution," "Hydrostatics," "Hydrodynamics"; READER'S GUIDE: "Gases," "Hydrodynamics," "Solids"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Elasticity," "Surface Tension," "Hydrodynamics"; LEARNING DIRECTORY: "Elasticity," "Harmonic Motion," "Surface Phenomena"; area and building audiovisual catalogs: "Matter," "Liquids," "Fluid Dynamics").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics

5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.1 Characteristics						
1. The student knows that the mass equivalent to a given amount of energy or the energy equivalent to a given amount of mass is given by the equation $E = mc^2$, where c is the speed of light.	H	G1 K2	3 4		2.2.5 4.1.1.1	(C)Energy (C)Mass (C)Data representation
2. The student knows that mass/energy can be neither created nor destroyed (and that we do not "convert one to the other") but that matter, not mass, can be converted to energy by the annihilation of nuclear particles; the mass of which then appears in various forms in nearby particles.	U H	G1 K2	4		4.1.1.1	(C)Energy (C)Mass
3. The student knows that the properties which matter exhibits identify the matter.	P I U H	K3	4		4.1	(C)Matter
4. The student knows that the properties which matter exhibits are dependent upon the atomic and molecular arrangements of the matter.	I U H	K3 K8	4		4.1.2.1 4.1.4	(C)Matter
5. The student knows the ways in which properties of matter can be observed.	P I U H	K7	4			(C)Matter
6. The student is able to observe the properties of matter and hypothesize the internal makeup of the matter.	I U H	P52	2		2.1.1.1	(C)Matter

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.1 Characteristics (Cont.)						
7. The student knows that masses of objects made of the same material are directly proportional to their sizes (volumes); the greater the size the more massive the object.	I U H	K10	4			(C)Mass
8. The student knows that when objects are not made of the same material, their sizes are not sufficient clues to their comparative masses.	P I U H	K3	4			(C)Mass

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.2 Solids, liquids, and gases						
1. The student knows that matter usually exists in one of three physical states: gases, solids, or liquids.	P I U H	K3 K5	4		4.2	(C)Matter
2. The student knows that all matter is composed of very small particles called molecules.	I U H	K2 K3	3 4		4.1.4	(C)Matter
3. The student knows that a molecule is the smallest particle of matter which still maintains the characteristics of that matter.	I U H	K2 K3	3 4		4.1.4	(C)Matter
4. The student knows that molecules are in constant motion.	I U H	K3 K8	4		4.1.4	(C)Matter
5. The student knows that in collisions between molecules, the conservation of momentum and kinetic energy is maintained.	U H	K3 K8	4		4.1.4	
6. The student knows that intermolecular forces are largely in solids and liquids and negligible in gases.	U H	K3 K5	4		4.1.4 4.2	
7. The student knows the relationship of molecular kinetic energy of molecules in solids, liquids, and gases.	U H	K8 K10	4		4.2	(C)Energy
8. The student knows that because particles of matter have kinetic energy, the particles can diffuse from one material to another.	U H	K3	4		4.2	

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.2 Solids, liquids, and gases (Cont.)						
9. The student knows that diffusion is the spreading of particles of one type of matter into another type of matter.	I U H	K2	3 4		4.2	
10. The student knows factors which influence diffusion (e.g., mass, size of the molecule, kinetic energy of the molecules).	I U H	K8	4		4.2	
11. The student knows that gases diffuse more rapidly than do liquids and liquids more rapidly than solids.	I U H	K5	4		4.2	
12. The student knows that solids have definite shape and definite volume.	P I U H	K3	1 4		4.2.3	(C)Matter
13. The student knows that solids are either crystalline (having a regular arrangement of particles) or amorphous (having a random arrangement of particles).	I U H	K3	1 4		4.2.3	(C)Matter
14. The student knows forces which influence the molecular cohesion of solids (e.g., metallic bond, covalent bond, ionic bond, hydrogen bond, Van der Waal's).	H	K3 K8	1 7		4.1.3	(C)Matter
15. The student knows the differences between kinds of crystals (e.g., atomic, molecular, ionic, macromolecular).	H	K5	1 4		4.2.3.1	(C)Matter

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.2 Solids, liquids, and gases (Cont.)						
16. The student knows that a liquid has a definite volume but not a definite shape.	P I U H	K3	1 4		4.2.2	(C)Matter
17. The student knows that liquids and solids are not very compressible.	P I U H	K3	1 4		4.2.2 4.2.3	(C)Matter
18. The student knows that gases (at room temperature) are composed of molecules or atoms.	I U H	K1 K3	1 4		4.2.1	(C)Matter
19. The student knows that a gas has no definite shape or volume.	P I U H	K3	1 4		4.2.1	(C)Matter
20. The student knows changes of state which occur in matter (e.g., melting, boiling, evaporating, condensing).	P I U H	K3 K4	1 4		4.2	(C)Matter
21. The student knows that substances may be separated from a liquid mixture by evaporation.	P I U H	K7	1 4		4.2.2	(C)Matter

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.3 Elasticity						
1. The student knows that tensile stress is defined as the ratio of the distributed force applied to the area over which it is applied.	H	K2	3 4		2.2.3	
2. The student knows that compressive stress is defined as the ratio of the distributed force applied to the area over which it is applied.	H	K2	3 4		2.2.3	
3. The student knows that pressure is defined as the distributed force applied (by a fluid, liquid, or gas) divided by the area over which it is applied.	H	K2	3 4		2.2.3	
4. The student knows that strain refers to the relative change in dimensions or shape of a body which is subjected to a stress.	H	K2	3 4			
5. The student knows that tensile strain is defined as the increase in length divided by the original length.	H	K2	3 4		2.2.3	
6. The student knows that compressive strain is defined as the decrease in length divided by the original length.	H	K2	3 4		2.2.3	
7. The student knows that volume strain is defined as the change in volume divided by the original volume.	H	K2	3 4		2.2.3	

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.3 Elasticity (Cont.)						
8. The student knows that as force is applied (causing an object such as a rod or wire to become longer or shorter), the ratio of force applied to the elongation or shortening is constant, provided the elastic limit is not exceeded. (Hooke's Law)	H	G1 K2	3 4			
9. The student knows that elastic limit is the point beyond which an object cannot be stretched and return to its original length.	P I U H	K2	3 4		2.2.3	

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.4 Simple harmonic motion (repeating motion)						
1. The student knows that motion which repeats itself is called periodic.	I U H	K1	3 4		2.2.3	(C)Motion
2. The student knows that periodic motion is often called simple harmonic motion.	I U H	K1	3 4		2.2.3	(C)Motion
3. The student knows that a period is defined as the time interval for a complete oscillation.	U H	K2	3 4		2.2.3	(C)Motion (C)Time
4. The student knows that frequency is defined as the number of complete vibrations or oscillations per unit of time.	I U H	K2	3 4			
5. The student knows that the period is the reciprocal of the frequency (i.e., the frequency divided into one--1--equals the the period).	H	K2	3 4			
6. The student is able to produce different periodic motions with objects of the same material.	H	P35	2			(C)Motion
7. The student is able to produce different periodic motions with objects of different materials.	H	P35	2			(C)Motion
8. The student is able to compare qualitatively the periods and frequencies of different periodic motions.	H	P45	2 3			(C)Motion

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.4 Simple harmonic motion (repeating motion) (Cont.)						
9. The student is able to compare quantitatively the periods and frequencies of different periodic motions.	H	P45	2			(C)Motion (C)Measurement
10. The student knows examples of periodic motion (e.g., the earth revolves about the sun, pendulums, bird's wings in flight).	H	K5	4			(C)Motion
11. The student knows that the period of the swing of a pendulum is dependent on the length of the pendulum.	I U H	K2 K8	4			(C)Motion
12. The student is able to determine the dependency of the period of the pendulum to the length of the pendulum.	I U H	P44	2 3			(C)Motion
13. The student knows that the period of the pendulum is dependent upon the acceleration due to gravity at that point on earth.	I U H	K2 K8	4			(C)Motion
14. The student knows the formula relationship for a pendulum between its period, its length and the acceleration due to gravity.	H	K2	4			(C)Motion

5. Physics

5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.5 Hydrostatics (fluids at rest)						
1. The student knows that density of a material is defined as the mass per unit of volume.	I U H	K2	3 4		2.2.3 4.1.1.3	(C)Density
2. The student is able to quantitatively determine the densities of different materials.	U H	P35	2 3		4.1.1.3	(C)Measurement
3. The student knows that pressure in or on a fluid (a liquid or a gas) at any point is the ratio of force exerted to the area over which it is exerted.	H	K2	3 4		4.2.1 4.2.2	
4. The student knows that in a fluid, pressure increases with depth and is not affected by the shape of the containing vessel or its dimensions.	U H	K2	4		4.2.1 4.2.2	
5. The student is able to quantitatively determine the pressure of a fluid at any point within it.	H	P35	2 3		4.2.1 4.2.2	
6. The student knows that if pressure is applied to an enclosed fluid, it will be transmitted unchanged to every portion of the fluid and to the walls of the vessel (Pascal's Law).	U H	G1 K2	4		4.2.1 4.2.2	
7. The student knows the ways in which pressure gauges measure pressure.	U H	K7	3 4		2.2.2.2	(C)Tools (C)Machine (C)Measurement

5. Physics

5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.5 Hydrostatics (fluids at rest) (Cont.)						
8. The student knows that atmospheric pressure generally decreases with an increase in altitude.	I U H	K2	4		6.2.2	
9. The student knows conditions that affect atmospheric pressure.	I U H	K8	4		6.2.2	
10. The student knows effects of changing atmospheric pressure.	I U H	K8	4		6.2.2	
11. The student knows accepted measurements for atmospheric pressure at sea level (e.g., 14.7 pounds/inches^2; 1.013×10^6 dyne/cm.^{2}; 1.013×10^5 Newton/meter^2).	H	G2 K2	4		6.2.2	(C)Measurement
12. The student knows that an object, when in a fluid, is buoyed up with a force equal to the weight of the displaced fluid (Archimedes' Principle).	U H	G1 K2	4		4.1.1.3	
13. The student is able to qualitatively determine the density of objects by how they float in a liquid.	H	P35 P45	2 3		4.1.1.3	
14. The student knows that specific gravity is the ratio of the mass of a substance to the mass of an equal volume of water.	H	K2	3 4			
15. The student knows that "floatability" varies with the type of material.	P I U	K3 K5 K8	4			

5. Physics

5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.5 Hydrostatics (fluids at rest) (Cont.)						
16. The student knows ways in which substances heavier than water can be made to float.	P I U	K7	4			
17. The student is able to make solid materials, with densities greater than that of water, float.	P I U	P76	2			
18. The student knows that a hydrometer is used to measure the density of liquids.	I U H	K7	4		2.2.2.2 4.2.2	(C)Tools (C)Measurement
19. The student knows ways in which a hydrometer is used (e.g., concentration of antifreeze in car radiator).	I U H	K7	4		2.2.2	(C)Tools (C)Measurement

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.6 Hydrodynamics (fluids in motion)						
1. The student knows the difference between streamline (laminar) and turbulent flow.	H	K5	3 4			(C)Motion
2. The student knows that increasing velocity causes a decrease in pressure (Bernoulli's Theorem).	H	G1 K2 K8	4			
3. The student knows that viscosity is a measure of the internal friction of a fluid.	I U H	K2	3 4			(C)Motion
4. The student is able to compare the viscosities of fluids qualitatively.	I U H	P45	2			(C)Motion
5. The student knows how to increase or decrease the viscosity of fluids.	I U H	K7 K8	4			(C)Motion
6. The student knows ways to use a siphon.	P I U H	K8	4			
7. The student knows ways to compute the rate of water flow.	I U H	K2	4			(C)Motion (C)Measurement

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.7 Surface phenomena of liquids						
1. The student knows that surface tension allows objects of densities greater than the liquid to remain floating on the surface of the liquid.	P I U H	K3	4		4.2.2	
2. The student knows that surface tension is caused by the unbalanced molecular attraction of surface molecules of the liquid compared to molecules below the surface.	I U H	K8	4		4.2.2	
3. The student knows examples of objects being supported on liquids by surface tension.	P I U H	K5	4		4.2.2	
4. The student knows the importance of surface tension to small insects, fish, and other water life.	P I U H	K8	4		3.4.1.2 3.5.1.3 4.2.2	
5. The student knows the ecological implications of changing the surface tension on bodies of water by introducing foreign materials and other liquids.	P I U H	K8	4		3.5.1.3	(C)Ecology
6. The student knows that adhesion is attraction of unlike molecules.	U H	K2	3 4		2.2.3 4.1.4	
7. The student knows that cohesion is the attraction of like molecules.	U H	K2	3 4		2.2.3 4.1.4	
8. The student knows that capillary action is the rising of liquids in tubes due to the combined effects of adhesion and cohesion.	U H	K2 K8	3 4		2.2.3 4.1.4	

5. Physics
5.8 Properties of matter

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.8.7 Surface phenomena of liquids (Cont.)						
9. The student knows examples of capillary action.	U H	K5	4		4.1.4	
10. The student knows that drops of water on a smooth surface are rounded and tend to get flatter as more water is added.	P I	K3	4		4.2.2	
11. The student knows that the surface of liquids tends to have a cohesiveness (surface tension) which holds it together.	P I U H	K3	4		4.2.2	
12. The student knows that surface tension (cohesiveness) can be changed by adding different materials to the water (e.g., soaps, alcohol).	P I	K8	4		3.5.1.3 4.2.2	

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9 Heat and thermodynamics						
1. The student knows the location and use of print and nonprint mateials related to heat and thermodynamics (e.g., card catalog: "Heat," "Thermodynamics," "Aerothermodynamics," "Heat Engines"; SUBJECT GUIDE TO BOOKS IN PRINT: "Thermodynamics," "Heat," "Thermal Elasticity," "Heat Engineering"; READER'S GUIDE: "Thermodynamics," "Heat," "Heat Transmission," "Heat Engines"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Thermodynamics," "Thermal Analysis," "Heat Conductivity"; LEARNING DIRECTORY: "Thermal Dynamics," "Thermodynamics," "Temperature," "Heat Transfer"; area and building audiovisual catalogs: "Heat," "Thermodynamics").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics

5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.1 Characteristics						
1. The student knows that heat is a form of energy.	I U	K3 K5	3 4		6.1.3.2	(C)Energy
2. The student knows that most sources of energy are conversions of other forms of energy (e.g., the sun; the earth's interior; chemical action; mechanical, electrical, and nuclear energy).	I U	K3 K4	4		6.1.3.2	(C)Energy
3. The student knows that the sun is one of the sources of heat.	P I	K3 K6	4		6.1.3.2	(C)Energy
4. The student knows that most materials expand when heated and contract when cooled.	P I	K8	4			
5. The student knows that heat is energy while it is going from one object to another.	I U	G2 K8	4		6.1.3.2	(C)Energy
6. The student knows that heat transfers from one material to another, going from a material of greater temperature to one of lesser temperature.	I U	G2 K2	4			
7. The student knows the ways in which materials change physical state as heat is applied.	P I	K8	4		4.2	(C)Change

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.1 Characteristics (Cont.)						
8. The student knows that thermodynamics is defined as the study of the quantitative relationships between heat and other forms of energy.	U H	K2	3 4		2.2.3	(C)Energy
9. The student knows that thermal equilibrium is the condition of two bodies if there is no thermal energy transfer between them when they are placed in contact.	U H	K2	3 4		2.2.3	

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.2 Temperature						
1. The student knows that temperature is a measure of heat.	P	K2	3 4		2.2.1.13	
2. The student knows that temperature is a measure of the transfer of heat.	I U	K2	3 4			(C)Measurement
3. The student knows that temperature is a statistical property of an object or region composed of many particles, quantifying the ability to cause heat energy to be transferred from one object or region to another.	H	K2	3 4		2.2.1.13	
4. The student knows that a thermometer is a device used to measure temperature.	P	K7	3 4		2.2.1.13 6.2.8	
5. The student knows that thermometers vary in scale to which they are calibrated and in materials used.	P	K3 K7	3 4		2.2.1.13	
6. The student knows uses of different types of thermometers.	P I U H	K7	3 4		2.2.1.13	(C)Measurement (C)Tools
7. The student knows that thermometers are designed around a physical property of matter that changes with a change of temperature (e.g., linear dimensions of solids, volume of liquids, pressure of gases, resistance of electrical conductors).	U H	K3 K8	3 4		2.2.1.1	(C)Tools

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.2 Temperature (Cont.)						
8. The student knows that the Celsius, formerly called Centigrade, and the Fahrenheit temperature scales are used most commonly.	I U	K1 K7	3 4		2.2.1.13	(C)Measurement
9. The student knows the differences between various temperature scales (e.g., Celsius, Fahrenheit, Kelvin, Rankine).	I U H	K2 K5	3 4		2.2.1.13	(C)Measurement
10. The student is able to select appropriate thermometers for various measurement purposes and conditions.	P I U H	P33	2 3		2.2.1.13	
11. The student is able to read a thermometer.	P I U H	P41 P45	2 3		2.2.1.13	

5. Physics
5.9 Heat and thermodynamics

5.9.3 Thermal expansion and contraction

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
1. The student knows that the amount of expansion or contraction of matter (for the same temperature change) varies with substances.	P I	K3 K5 K8	4			
2. The student knows that expansion occurs along the entire heated region of an object.	P I	K3 K8	4			
3. The student knows the expansion properties of solids (e.g., linear, area, volume).	I U H	K2 K3	4		4.2.3	
4. The student knows that the coefficient of expansion is the unit change of dimension when the temperature is increased by one degree.	U H	K2	3 4		2.2.3	
5. The student knows that the coefficient of contraction is the unit change of dimension when the temperature is decreased by one degree.	U H	K2	3 4		2.2.3	
6. The student knows the mathematical relationships for solids and liquids between the coefficients of dimensional expansion, the original dimension, and the change in temperature.	U H	K2 K3 K5 K8	3 4			

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.3 Thermal expansion and contraction (Cont.)						
7. The student is able to determine the coefficient of linear expansion of solids in the laboratory.	H	P35 P63	2 3		2.1.4.5	
8. The student knows that liquids and gases undergo volume expansion or contraction when their temperature is changed.	P I	K8	4		4.2.1 4.2.2	
9. The student knows the ways in which water differs from other liquids in its expansion and contraction near the freezing point.	U H	K3 K5	4		4.2.2	
10. The student knows that the coefficient of expansion is approximately the same for all gases.	H	G2 K2 K5	3 4		4.2.1	
11. The student knows that the coefficient of expansion for gases is nearly constant at all temperatures.	H	G2 K2 K5	3 4		4.2.1	
12. The student knows that the volume of a gas enclosed at a constant pressure will increase or decrease in direct proportion to its Kelvin temperature (Charles' Law).	H	G1 K2 K8	3 4		4.2.1	

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.3 Thermal expansion and contraction (Cont.)						
13. The student knows that the expansion or contraction of a gas is 1/273 of its volume at 273°K. for each degree of temperature change.	H	K2 K8	3 4		4.2.1	
14. The student knows that the gas laws apply strictly to an ideal gas (a gas consisting of infinitely small molecules which exert no forces on each other) and only approximately to all real gases.	H	G1 K9	3 4		4.2.1	

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.4 Quantity of thermal energy						
1. The student knows that heat is energy in the process of transfer between a body and its surroundings as a result of temperature differences.	U H	K2 K3	3 4		2.2.3	(C)Energy
2. The student knows that the amount of heat required to raise the temperature of equal masses the same number of degrees, varies with the kind of matter.	I U H	K2 K3 K5 K8	3 4			
3. The student is able to calculate the amount of heat needed to raise the temperature of an object a certain number of degrees.	U H	P35 P63	2 3		2.1.3.5	
4. The student knows that the units for the measurement of heat are calories, joules, ergs, and British Thermal Units.	H	K1 K2	3 4		2.2.1.1	(C)Measurement
5. The student knows that the British Thermal Unit is the amount of heat needed to raise the temperature of one pound ot water one degree Fahrenheit.	H	K1 K2	3 4		2.2.1.1	
6. The student knows that a calorie is the amount of heat needed to raise the temperature of one gram of water one degree Celsius (one calorie is equal to 4.186 joules).	U H	K1 K2	3 4		2.2.1.1	(C)Measurement

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.4 Quantity of thermal energy (Cont.)						
7. The student knows that the heat capacity (specific heat) of a substance is defined as the number of calories needed to raise one gram of the substance one degree Celsius.	U H	K1 K2	3 4		2.2.3	(C)Measurement
8. The student knows ways of determining the heat capacity (specific heat) of substances.	H	K7	3 4			(C)Measurement
9. The student knows ways of determining the amount of heat energy lost or gained by an object.	H	K7	3 4			(C)Measurement
10. The student knows that the heat of combustion of a substance is the quantity of heat liberated per unit mass, or per unit volume, when the substance is completely burned.	H	K2	3 4			
11. The student knows that different substances have different specific kindling temperatures (i.e., the lowest temperature at which a substance will burn).	P I U H	K3 K5	4			

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.5 Change of state						
1. The student knows that the word "state" in physics refers to the condition of the matter's molecular or atomic organization.	I U H	K1 K2	3 4		2.2.3 4.2	
2. The student knows that matter can change state.	P I	K3 K4	4		4.2	(C) Change, physical (C) Matter
3. The student knows the meanings of terms used to identify states of matter (i.e. solid, liquid, gas).	P I	K2	3 4		4.2	
4. The student knows the meanings of terms used to describe changes of state (e.g., from a solid to a liquid--melt; a liquid to a gas--vaporize; a gas to a liquid--condense; a liquid to a solid--solidify; a solid to a gas--sublimate).	P I	K2	3 4		2.2.3 4.2	
5. The student knows meanings of terms used to describe temperatures at which changes of state occur (e.g., melting point, freezing point, boiling point, condensation point, vaporization point).	P I	K2	3 4		2.2.3 4.2	
6. The student knows the difference between melting and dissolving.	P I	K5	3 4		4.2	(C) Change, physical

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.5 Change of state (Cont.)						
7. The student knows that when the boiling point of liquid in an open container is reached, all additional heat is used in changing its phase to a gas.	I U H	K3 K4 K8	4		4.2	(C) Change, physical
8. The student knows that the heat of vaporization of a substance is the number of calories needed to change one gram of a liquid to one gram of a gas without changing the temperature. (In the reverse process, the same amount of heat is released.)	U H	K2	3 4		2.2.3 4.2	(C) Change, physical
9. The student is able to calculate the heat needed to vaporize given amounts of liquids.	U H	P35 P63	2 3		4.2	(C) Change, physical
10. The student knows that the heat of fusion of a substance is the number of calories needed to change one gram of the substance from a solid to a liquid without changing the temperature of that substance. (In the reverse process, the same amount of heat is released.)	U H	K2	3 4		2.2.3 4.2	
11. The student is able to calculate the heat needed to melt various substances.	H	P35 P63	2 3			(C) Change, physical

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.5 Change of state (Cont.)						
12. The student knows that evaporation and melting absorb heat (cool the surroundings) and that condensation and solidification release heat (warm the surroundings).	H	K8	4			(C) Change, physical
13. The student knows that there is a gain or a loss of energy when the state of matter is changed even though there is no change in temperature.	H	K8	4		4.2	(C) Change, physical (C) Energy
14. The student knows that sublimation is the process where some substances may change directly from a solid to a gas without the liquid state occurring.	U H	K2 K4	3 4		2.2.3 4.2	(C) Change, physical
15. The student knows ways to determine the heat of fusion of a substance.	I U H	K7	3 4			(C) Measurement
16. The student knows ways to determine the heat of vaporization of a substance.	I U H	K7	3 4			(C) Measurement
17. The student knows the effect of pressure and dissolved materials within a substance on the melting/freezing point and the vaporizing/condensing point of that substance.	I U H	K8	4		4.2	(C) Change, physical

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.5 Change of state (Cont.)						
18. The student knows that the triple point of water is the temperature at which ice, liquid water, and water vapor coexist in equilibrium. (This temperature is 273.16°K. and is a standard fixed point of thermometry.)	U H	K2	3 4		4.2	(C) Change, physical
19. The student knows the relationship between the process of boiling and vapor pressure.	U H	K2 K8	3 4		4.2	(C) Change, physical
20. The student knows that evaporation is the changing of a liquid to a vapor (the molecules escape the liquid into the surrounding regions).	P I	K2 K4	3 4		2.2.3 4.2.2	(C) Change, physical
21. The student knows that molecules leave and return to the surface of a liquid.	H	G2 K4 K6	4		4.2.2	
22. The student knows that evaporation occurs when the rate of molecules leaving a surface exceeds the rate of molecules returning.	H	G2 K4	4		4.2.2	

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.6 Transfer of heat						
1. The student knows that heat always travels from the matter having the higher temperature to the matter having the lower temperature until they are both the same temperature.	I U H	G2 K2 K4	4			
2. The student knows that during heat transfer, the greater the temperature difference, the faster the rate of transfer.	I U H	K8	4			
3. The student knows the processes of heat transfer (conduction, convection, and radiation).	I U H	K7	3 4			
4. The student knows that heat can be transferred by all three processes (convection, conduction, radiation) at once. (Generally, one process occurs to a greater degree than others.)	I U H	K4 K6	4			
5. The student is able to identify the different methods of heat transfer.	I U H	P44 P45	3 4			
6. The student knows that conduction is the transfer of heat through a material via vibration of its molecules.	I U H	K2	3 4		2.2.3	
7. The student knows that heat is transferred in solids by conduction.	I U H	K6	4		4.2.3	

5. Physics
5 9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.6 Transfer of heat (Cont.)						
8. The student knows that metals generally conduct heat better than other materials.	P I U	G2 K5	4			
9. The student knows that liquids and gases are poor conductors of heat, but are good convectors.	I U H	K3 K5	4		4.2.1 4.2.2	
10. The student knows that the rate at which heat travels through materials differs with the kinds of material.	P I U	K5 K8	3 4			
11. The student knows that the rate of heat transfer through a slab of material is directly proportional to both the area and temperature difference but inversely proportional to the thickness.	U H	K2 K8	4		6.2.3	
12. The student knows that the coefficient of thermal conductivity is a measure of a material's ability to conduct heat.	U H	K2	3 4		2.2.3	
13. The student knows applications, in his environment, of knowledge about heat conduction (e.g., building construction, cooking utensils, clothing).	P I U H	K7	4 5 7			(C)Technology
14. The student knows that convection is the transfer of heat from one place to another by the actual motion of the hot material.	I U H	K2	3 4		2.2.3 6.2.3	

5. Physics

5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.6 Transfer of heat (Cont.)						
15. The student knows that convection can be forced (caused by a pump or fan) or natural (flow caused by a difference in density).	I U H	K8	4		6.2.3	
16. The student knows factors which determine the rate at which convection will occur from a region.	I U H	K8	4		6.2.3	
17. The student knows that radiation is the transfer of heat via electromagnetic waves.	H	K2	3 4		6.1.3.2	
18. The student knows the properties that electromagnetic waves and light have in common.	H	K3 K5	3 4		6.1.3.2	
19. The student knows that radiated thermal energy is called radiant energy.	H	K1 K2	3 4		2.2.3 6.1.3.2	(C)Energy
20. The student knows that the sun is a major source of radiant energy.	I U H	K6	4		6.1.3.2	(C)Energy
21. The student knows characteristics which affect the emission and absorption of radiant energy (e.g., nature of the surface, temperature).	I U H	K3 K8	4			
22. The student knows that a material which is a good absorber of radiant energy is a good emitter, and a poor absorber is a poor emitter.	I U H	K3	4			

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.6 Transfer of heat (Cont.)						
23. The student knows that dark colored materials tend to be good absorbers of radiant energy.	P I U H	K3	4			
24. The student knows that shiny and bright colored materials are good reflectors.	P I U H	K3	4			
25. The student is able to calculate the heat exchanged between objects (e.g., iron at one temperature is placed in water at a different temperature).	U H	P35	2 3			

5. Physics
5.9 Heat and thermodynamics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.9.7 Thermodynamics						
1. The student knows that the quantity of energy supplied to a system (in the form of heat) is equal to the work done by the system plus the change in internal energy of the system (First Law of Thermodynamics).	H	G1 K2	3 4			(C)Energy
2. The student knows the impossibility of constructing an engine which can convert heat energy into an equal amount of mechanical energy (Second Law of Thermodynamics).	H	G1 K2	3 4			(C)Energy (C)Entropy
3. The student knows that a natural process always occurs in such a direction as to cause an increase in the entropy (the physical quantity which relates to the inability of a system to do work) of the system and the environment.	H	G1 K2 K3	3 4		4.6	(C)Entropy
4. The student knows that entropy relates to disorder or lack of organization (inability of a system to do work).	H	K2 K3	3 4		4.6	(C)Entropy
5. The student knows applications of the laws of thermodynamics in everyday situations.	H	K7	4 5 7			(C)Energy

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10 Waves						
1. The student knows the location and use of print and nonprint materials related to waves (e.g., card catalog: "Waves," "Wave Mechanics," "Sound Waves," "Ocean Waves"; SUBJECT GUIDE TO BOOKS IN PRINT: "Wave Guides," "Wave-Motion, Theory of," "Waves"; READER'S GUIDE: "Waves," "Wave Mechanics," "Shock Waves"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Diffraction," "Refraction," "Wave Motion, Theory of"; LEARNING DIRECTORY: "Wave, Interference," "Wave Reflection," "Wave Propagation"; area and building audiovisual catalogs: "Waves," "Wave Mechanics").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.1 Characteristics						
1. The student knows that a mechanical wave is defined to be a disturbance that passes through or over a given medium that causes no permanent change in the medium or in its position.	H	K2	3 4		2.2.3	
2. The student knows that waves are a phenomena by which energy may be transported from one place to another.	H	K7	4			(C)Transportation
3. The student knows examples of mechanical waves (e.g., ocean waves, earthquake waves, sound waves).	H	K5	4		6.3.2.2.1.2 6.4.3.5	
4. The student knows that certain (non-mechanical) waves can move through a vacuum (space).	H	K3 K6	4			
5. The student knows that light waves are a form of electromagnetic waves.	U H	K3 K5	3 4			
6. The student knows that periodic waves are defined to be a series of waves going past a given point at regular time intervals.	H	K2	3 4		2.2.3	
7. The student knows that the period of a wave is the length of time it takes one complete wave to pass a given point.	H	K2	3 4			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.1 Characteristics (Cont.)						
8. The student knows that the frequency of a wave is defined to be the number of complete waves going past a given point in a given period of time.	H	K2	3 4		2.2.3	
9. The student knows that the wave length is defined to be the distance between a given point on one wave to the like point on an adjacent wave.	H	K2	3 4		2.2.3	
10. The student knows that a longitudinal wave is defined to be one in which the disturbance is vibrating in the same direction as the direction the wave is moving.	H	K2	3 4		2.2.3	
11. The student knows that a transverse wave is defined to be one in which the disturbance is vibrating at right angles to the direction the wave is traveling.	H	K2	3 4		2.2.3	
12. The student knows that the speed of a wave is dependent upon the type of wave and condition of the medium in which it is traveling.	H	K3 K8	4		6.4.3.5	
13. The student knows that in periodic wave motion the speed of the wave is a product of the frequency and wave length.	H	K2	3 4			
14. The student is able to calculate the length, frequency, or speed of a wave when given the other two components.	H	P35	2 3			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.1 Characteristics (Cont.)						
15. The student knows that the amplitude of a wave is the maximum displacement of either the crest or trough for a transverse wave and either the compression or rarefaction of a longitudinal wave.	H	K2	3 4		2.2.3	
16. The student knows the properties of transverse waves.	H	K3	4			
17. The student knows the properties of longitudinal waves.	H	K3	4			
18. The student knows the common properties of waves (e.g., rectilinear propagation, reflection, refraction, diffraction, interference).	H	K3	4			
19. The student knows that waves are either transmitted, reflected, or absorbed by materials.	H	G2 K7	4			
20. The student knows that phase of a wave refers to the position or motion of a point of the wave.	H	K2	3 4		2.2.3 6.4.3.5	
21. The student knows that when two waves are in phase they are identical.	H	K2 K5	3 4		6.4.3.5	

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.1 Characteristics (Cont.)						
22. The student knows that when two waves are out of phase they will not match in terms of their displacement.	H	K3 K5	4		6.4.3.5	
23. The student knows ways in which principles and concepts of waves are applied to specific areas of science (e.g., sound, heat, electromagnetic energy, water waves, earthquakes, the earth's interior, the earth's atmosphere).	H	K7	4		6.4.3.5	

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.2 Rectilinear (straight-line) propagation (travel)						
1. The student knows that the direction of travel of a wave is perpendicular to the wave itself (wave front) as long as the medium is uniform.	H	K2	3 4		6.4.3.5	
2. The student knows that in a uniform medium the velocity of propagation of waves is constant.	H	K2	3 4			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.3 Reflection						
1. The student knows that waves are reflected (turned back) when they strike a medium which curves the wave at a different velocity than the original medium of travel.	H	K1 K2	3 4		6.4.3.5	
2. The student knows the terms related to the reflection of waves (e.g., incident--coming towards, reflected--bounced from, the normal--an imaginary line perpendicular to another line).	H	K1 K10	3 4			
3. The student knows ways to measure the angles of incidence and reflection in a physical situation.	H	K7	3 4			
4. The student knows that when a wave reflects at a point, the angle of incidence is equal to the angle of reflection (Law of Reflection).	H	G1 K2	3 4			
5. The student knows that the ray of the incident wave train, the ray of the reflected wave train, and the normal all lie in the same plane.	H	K2 K3	3 4			
6. The student knows that waves striking a surface which is not smooth will reflect in many directions.	H	K3 K6 K8	4			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.3 Reflection (Cont.)						
7. The student knows that reflected waves from a surface may or may not be in phase with the incident waves.	H	K3 K6	4			
8. The student knows the ways in which reflecting conditions affect the phase of waves.	H	K8	4			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.4 Refraction						
1. The student knows that refraction is the bending of a wave from its original direction of travel as the wave train passes obliquely (at an angle) into another medium in which the velocity of the wave is different.	H	K2	3 4		2.2.3	
2. The student knows ways of determining the indices of refraction.	H	K2 K3 K7	4			
3. The student knows that refraction can be mathematically described by Snell's Law which states: The product of the sine of the angle of incidence and the index of refraction of the incident medium is equal to the product of the sine of the angle of refraction and the index of refraction of the refracting medium.	H	K1 K2	3 4			
4. The student knows that the ray of the incident wave train, the ray of refracted wave train, and the normal to the surface all lie in the same plane.	H	K2 K3	3 4			
5. The student knows that the index of refraction of a material is the ratio of the speed of the wave in a standard medium to the speed of the wave in some other medium.	H	K2	3 4		2.2.3	

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.5 Diffraction						
1. The student knows that diffraction is the bending of a wave train around the edge of an opaque object.	H	K2	3 4		2.2.3	
2. The student knows that the amount of bending of a wave train depends on the wave length of the wave and the size of the opening the wave is passing through.	H	K3 K8	4			
3. The student is able to produce diffraction in a physical situation with different types of waves such as sound, light, and water.	H	P63 P76	2 3			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.6 Interference of waves						
1. The student knows that when two waves superimpose (meet; come together) the total displacement, at that time, of the medium is determined by algebraically summing the individual displacements of the single waves (Principle of Superposition).	H	G1 K2	3 4			
2. The student knows that the resulting effect of the superposition of waves is called interference.	H	K2 K8	3 4		2.2.3	
3. The student knows that interference may be constructive or destructive.	H	K8	3 4			
4. The student knows how constructive and destructive interference is produced with waves.	H	K8	3 4			
5. The student knows that standing waves are waves that have amplitudes that stay everywhere the same, and are the result of reflections of the wave from boundaries that absorb as much energy as is put in by any driving vibrations.	H	K1 K2 K3 K8	3 4			

5. Physics
5.10 Waves

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.10.6 Interference of waves (Cont.)						
6. The student knows that nodes and nodal lines are points and lines of zero displacement, when two waves destructively interfere in a standing wave.	H	K1 K2 K8	3 4			
7. The student knows that antinodes are points and antinodal lines are lines, where two waves constructively interfere in a standing wave.	H	K1 K2 K8	3 4			
8. The student is able to produce constructive and destructive interference with different types of waves in physical situations.	H	P63 P76	2 3			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11 Light (electromagnetic radiation)						
1. The student knows the location and use of print and nonprint materials related to light (e.g., card catalog: "Light," "Color," "Photometry," "Lasers"; SUBJECT GUIDE TO BOOKS IN PRINT: "Light," "Lasers," "Photometry," "Polarization"; READER'S GUIDE: "Light," "Polarization," "Lasers," "Electromagnetic Theory"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Photoelectric Effect," "Light," "Interference (Light)," "Diffraction"; LEARNING DIRECTORY: "Light,Shadow," "Light Refraction," "Light, Color"; area and building audiovisual catalogs: "Light," "Lasers," "Refraction").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.1 Characteristics						
1. The student knows that "visible light" is a special name given to electromagnetic radiation which the human eye and brain can perceive.	I U H	K1 K2	3 4		2.2.3	(C) Perception
2. The student knows that since light is electromagnetic radiation, then all that applies to light applies also to all electromagnetic radiation.	I U H	K3 K7	3 4			
3. The student knows that light is capable of traveling through space (i.e., a vacuum), and through some materials.	I U H	K3	4			
4. The student knows that light travels in all directions from a point source.	I U H	K3	4		6.1.3.2	
5. The student knows that an illuminated object is an object which is visible because of the light reflected from it.	I U H	K2 K8	3 4		6.1.3.4.1	
6. The student knows that a luminous object gives off light (e.g., firefly, flame).	I U H	K3	4		6.1.3.2	
7. The student knows that light is reflected, refracted, absorbed, and transmitted by materials to different degrees, depending upon the materials and their physical conditions.	I U H	K3 K8	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.1 Characteristics (Cont.)						
8. The student knows the ways in which light waves compare to other types of waves (e.g., rectilinear propagation--travels in straight lines in a uniform medium, reflection, refraction, interference, diffraction).	H	K5	4			
9. The student knows that light has two properties of particles (indivisibility, discreteness).	H	K3	4			
10. The student knows the historical development of man's understanding of the nature of light.	I U H	K4	4			(C)History of science
11. The student knows the regions of the electromagnetic spectrum and the defining frequencies and/or wave lengths of these regions.	U H	K2 K3	3 4			
12. The student knows that ultraviolet radiation and infrared radiation are the wave lengths just outside the visible range.	U H	K3 K6	3 4			(C)Perception
13. The student knows that the assumption that the speed of light is constant is a fundamental tenet of Einsteinian relativity used to simplify that theory: that the simplification results in the changes of mass, length, and time (when observed from moving frames of reference) that are simple rather than complex.	H	G2 K2 K6	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.1 Characteristics (Cont.)						
14. The student knows that the speed of light in a vacuum is taken as a universal and fundamental constant, and is equal to 300 million meters per second or 186,000 miles per second (correct to three significant figures).	H	G1 K2 K9	3 4			
15. The student knows different methods of measuring the speed of light.	H	K7	3 4			(C)Measurement
16. The student knows examples of transparent materials which are readily passed through by light (e.g., air, water, glass).	I U H	K3 K5	4 5			
17. The student knows examples of opaque materials which do not transmit light (e.g., wood, sheets of metal, leather).	I U H	K3 K5	4 5			
18. The student knows that translucent materials (thin paper, frosted glass) transmit some light but at the same time diffuse (scatter) the light that is transmitted.	I U H	K3 K8	4			
19. The student is able to classify objects according to their ability to transmit light.	I U H	P33	2		2.1.3.3	

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.1 Characteristics (Cont.)						
20. The student knows that those light rays which come directly from a source of light are direct light rays and those rays which are reflected from an object are indirect light rays.	I U H	K2 K3	3 4		6.1.3.2	
21. The student knows that light is a transverse wave.	U H	K3	4			
22. The student knows that light has characteristics of both waves and particles.	U H	K3	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.2 Shadows						
1. The student knows that a shadow is defined as an image formed when rays from a source of light are cut off by an interposed body (opaque object).	P I U H	K2	3 4		2.2.3 6.1.3.2	
2. The student knows the cause of sharp and diffused shadows.	I U H	K8	4		6.1.3.2	
3. The student is able to produce shadowed regions.	P I	P35 P63	2 3		6.1.3.2	
4. The student knows that shadows can be changed by changing the position of the light source.	P I	K8	4		6.1.3.2	
5. The student knows that an eclipse results when light from a luminous body is blocked by another celestial body.	P I U H	K8	4		6.1.3.2	
6. The student knows the difference between a solar eclipse and a lunar eclipse.	P I U H	K5	4		6.1.3.2 6.1.3.4.1	
7. The student knows the relative position of sun, moon, and earth during an eclipse.	P I U H	K6 K8	4		6.1.3.2 6.1.3.4.1	

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.3 Photometry						
1. The student knows that photometry is the science which treats the measurement of light, luminosity, and illumination.	U H	K2	3		2.2.3	(C)Measurement
2. The student knows that brightness of light is a comparison of sensations (usually to the human eye/brain produced by luminous or illuminated materials.	U H	K2	4			(C)Perception
3. The student knows that the standard measure of light intensity from a luminous source is the standard "candle."	H	K1 K2	3 4		2.2.3	
4. The student knows that luminous flux is the quantity of radiation energy that arrives at or leaves a surface per unit of time, and produces visible sight. (The unit of measure is the lumen.)	H	K2	3		2.2.3	
5. The student knows the illumination of a surface is the luminous flux per unit area of illuminated surface (lumens per unit area; lux = 1 lumen per sq. meter).	H	K2	3			
6. The student knows that foot candle is a unit of illumination. (One foot candle is one lumen per square foot.)	H	K1 K2	4		2.2.3	

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.3 Photometry (Cont.)						
7. The student knows that the amount of illumination of surface by a light source decreases according to the inverse square of the distance between the illuminated surface and the source (Inverse Square Law).	H	G1 K8	4			
8. The student is able to use a photometer.	H	P16	2			(C)Measurement (C)Tool

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.4 Reflection						
1. The student knows that most things are seen by reflected light.	I U H	G2 K8	4		2.1.1.1	(C) Perception
2. The student knows that all the light in a beam is traveling in approximately the same direction.	I U H	G2 K3 K6	4			
3. The student knows that a pencil of light is a narrow beam of light bounded by parallel lines.	U H	K2	3		2.2.3	
4. The student knows that the rules and laws which apply to the reflection of waves apply also to the reflection of light.	H	G1 K7	4			
5. The student knows that reflectance is the ratio of the amount of reflected light from a surface to the amount of light incident upon it.	H	K2	3 4		2.2.3	
6. The student knows that diffusion is the reflection or scattering of light in many directions from a nonsmooth surface.	H	K2	3 4		2.2.3	
7. The student knows that when a surface reflects light with neglible scattering it is called specular reflection.	H	K1 K2	3 4		2.2.3	

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.4 Reflection (Cont.)						
8. The student knows that a polished surface will provide an image of the source of the light that is being reflected.	P I U H	K8	4			
9. The student knows that "mirror" usually refers to a polished surface.	P I U H	K1 K2	3		2.2.3	
10. The student knows that a plane mirror (a flat mirror) always forms a virtual image.	I U H	K8	4			
11. The student knows that a virtual image is an image which only appears to the eye to be formed by rays of light.	I U H	K2	3		2.1.1.1 2.2.3	(C)Perception
12. The student knows that a real image is an image formed by actual rays of light.	U H	K2 K8	3 4		2.2.3	
13. The student knows that the virtual image found by a plane mirror is reversed right to left in relationship to the source of the light.	I U H	K6	4		2.1.1.1	(C)Perception
14. The student knows that the virtual image appears to be as far behind the surface as the object is in front (the size of the image is the same as that of the object).	I U H	K6	4		2.1.1.1	(C)Perspective (C)Perception

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.4 Reflection (Cont.)						
15. The student is able to create, match, and complete patterns with a mirror(s).	P I	P76	2		2.1.6.4	(C)Perception (V)Creativity
16. The student knows that beams of light can be controlled and changed by changing mirror positions.	P I U	K8	4			
17. The student knows that convex mirrors curve outward.	I U H	K2 K3	3		2.2.3	
18. The student knows that concave mirrors curve inward.	I U H	K2 K3	3		2.2.3	
19. The student knows that the principal focus is the point on the principal axis at which all rays of light, originally parallel to the axis, meet or would meet.	U H	K2 K6	4		2.2.3	
20. The student knows that converging mirrors are concave.	U H	K2 K3	3			
21. The student knows that diverging mirrors are convex.	U H	K2 K3	3			
22. The student knows that converging mirrors may form either a real image or a virtual image depending upon where the source of light is placed with respect to the focus.	U H	K6 K8	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.4 Reflection (Cont.)						
23. The student knows that a convex mirror always forms a virtual image.	U H	K8	4			
24. The student knows that concave mirrors can form real images which are magnifications of the source of light.	U H	K8	4			
25. The student is able to represent the physical situation produced when a source of light is mirrored and an image is formed (e.g., ray diagram, equations).	H	P76	2			(C) Data representation
26. The student is able to determine physical properties of mirrors.	I U H	P76	2			
27. The student knows uses of convex and concave mirrors.	U H	K7	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.5 Refraction						
1. The student knows that objects appear to be bent when placed half in and half out of a pool of water (e.g., stick, pencil).	P	K8	4 5		2.1.1.1	(C)Perspective
2. The student knows the ways in which water distorts images (e.g., location, size).	P I U H	K8	4 5		2.1.1.1	(C)Perspective
3. The student knows that refraction of light is the bending of light rays as they pass (at an angle to a perpendicular to the surface) into a medium of different density (where the speed of light is different).	U H	K2	3 4		2.2.3	
4. The student knows that light rays bend away from (speed up) the perpendicular when going into a medium of less density.	U H	K4 K8	4			
5. The student knows that light rays bend toward (slow down) the perpendicular when going into a medium of greater density.	U H	K4 K8	4			
6. The student knows that many phenomena related to size and position of objects in transparent media can be explained by refraction.	I U H	K8	4		2.1.1.1	(C)Perspective

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.5 Refraction (Cont.)						
7. The student knows that the rules and equations which apply to the refraction of waves apply also to the refraction of light.	H	G1 K7	3 4			
8. The student knows that the index of refraction of a vacuum is established as 1.0 for comparative purposes.	H	K2	3 4			
9. The student knows that the indices of refraction of materials are always greater than 1.0.	H	K2	3 4			
10. The student knows that the index of refraction of any particular medium is usually independent of the angle of incidence.	H	K2	1 4			
11. The student knows that total internal reflection occurs when light reflects from a boundary between two media, when it is incident from the media in which light travels the slowest and the angle of incidence is greater than a critical angle.	H	K6 K8	4			
12. The student knows applications of total internal reflection.	H	K7	4 5			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.5 Refraction (Cont.)						
13. The student is able to determine the indices of refraction of materials in physical situations.	H	P11 P16	2 3 5			
14. The student is able to apply the equations developed for the refraction of waves to the refraction of light.	H	P35	2 3			
15. The student knows that refracting materials can be physically shaped in such a way as to control the direction of light passage through them (e.g., lenses).	U H	K8	4			
16. The student knows that lenses are classified as diverging or converging.	U H	K5	4		2.2.2.1	
18. The student knows that a diverging lens spreads the light rays.	U H	K2 K8	3 4		2.2.2.1	
19. The student knows that a convex lens can form either real or virtual images depending on where the illuminating object is placed with respect to the focal point of the lens.	U H	K8	4		2.2.2.1	

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.5 Refraction (Cont.)						
20. The student knows that the size of the images formed by lenses depends on the positioning of the illuminating objects and the lens' focal length.	U H	K8	4		2.1.1.1	(C)Perception
21. The student knows that a concave lens forms virtual images of the illuminating object.	U H	K2 K8	3 4			
22. The student is able to represent the relative positions and sizes of the images formed by lenses of the illuminating objects (e.g., ray diagram).	H	P76	2 3			
23. The student is able to use the equations which have been developed for lenses.	H	P35	2 3			
24. The student knows that lenses of different sizes, shapes, and kinds of glass are used in optical devices to insure the desired effect (e.g., spectacles, microscopes, magnifying glasses, telescopes, cameras).	H	K7	4		2.1.1.1 2.2.2.1 6.1.4.2	(C)Perception
25. The student knows that the lens in the eye forms a real image on the retina; the image is inverted.	I U H	K8	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.5 Refraction (Cont.)						
26. The student knows that clear curved objects have properties of magnification (e.g., water drops, clear marbles, bottles of water).	P I U H	K3	4 5			
27. The student knows that the hand lens is used to magnify (make objects appear larger).	P I U H	K7	4 5		2.1.1.1 2.2.2.1 6.3.2.5.2	(C) Perception

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.6 Color						
1. The student knows that prisms are triangular pieces of glass that cause a beam of light to spread out (disperse).	P I U H	K2 K8	3		2.2.1.1 2.2.2.1 2.2.3 4.8	(C) Tools
2. The student knows that sunlight or "white" light will disperse into the colors of the rainbow (red, orange, yellow, green, blue, indigo, and violet) and the colors in between.	P I U H	K3	4		6.1.3.2	(C) Color
3. The student knows that a spread of colors, such as is produced by a prism, is called a spectrum.	I U H	K2	3 4		2.2.3	(C) Color
4. The student knows that the colors of light are properties of their frequencies.	U H	K8	4			(C) Color
5. The student knows that colors are perceptions of the human mind.	P I U H	K2 K8	1 4		2.1.1.1	(C) Self-knowledge (C) Color (C) Perception
6. The student knows that red light is the lowest frequency and violet light is the highest frequency that the eye can detect under normal conditions.	I U H	K5	4 5		2.1.1.1 4.8	(C) Color (C) Perception
7. The student knows how color and light frequency are related.	U H	K8	4		4.8	(C) Color

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.6 Color (Cont.)						
8. The student knows that polychromatic light is light which consists of several colors (frequencies).	H	K2 K3	3 4		2.2.3	(C)Color
9. The student knows that monochromatic light is light which is of only one color (frequency).	H	K2	3 4		2.2.3 4.8	(C)Color
10. The student knows that a prism "breaks" light up because, for a given material, each frequency of light has a different index of refraction and, therefore, is bent to a different degree than other frequencies of light.	H	K8	4		2.2.1.1 4.8	(C)Tool (C)Color
11. The student knows that the higher frequencies of light are refracted more than the lower frequencies.	H	K5	4		4.8	(C)Color
12. The student is able to use a prism and a polychromatic light to produce a spectrum of colors.	I U H	P76	3		2.2.1.1	(C)Tool (C)Color
13. The student knows that an opaque object is a certain color because of the frequency of light which it reflects to the eye.	I U H	K8	4		2.1.1.1	(C)Color (C)Perception

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.6 Color (Cont.)						
14. The student knows that a yellow object is yellow because it reflects more yellow light than light of other wave lengths.	I U H	K8	4			(C)Color
15. The student knows that an object is black because it reflects no light, absorbing it all.	I U H	K8	4			(C)Color
16. The student knows that an object is white because it reflects all light.	I U H	K8	4			(C)Color
17. The student knows that the color which an opaque object appears to be is dependent on the frequency (color) of light which is, at that time, incident upon it.	I U H	K8	4			(C)Color
18. The student is able to use different monochromatic lights to cause objects to "take on" different colors.	I U H	P76	2 3		2.2.2	(C)Color
19. The student knows that a transparent object is dependent upon the frequency (color) of light which it will transmit.	I U H	K8	4 7			
20. The student is able to produce various color effects using different polychromatic lights and different colors of transparent material.	I U H	P76	2 3 7			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.6 Color (Cont.)						
21. The student knows that complementary colors are any pair of colors which will combine to produce white light.	I U H	K2 K8	3 4 7		2.2.3	(C)Color
22. The student knows that two colors of light are "complementary" if there exists some proportions of them which added together produce white light.	I U H	K2 K3	3 4			(C)Color
23. The student knows the various primary colors which can be combined to produce most other colors.	P I U H	K2 K3	4 7			(C)Color
24. The student is able to combine colors to produce a desired effect.	P I U H	P35	4 7		2.1.4.7	

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.7 Interference						
1. The student knows that light can be caused to undergo interference phenomenon.	H	G2 K3	4			
2. The student knows interference phenomenon with light can be demonstrated by allowing two light beams from a single source to produce patterns of constructive and destructive interference.	H	K2 K8	4			
3. The student knows that interference of light can be produced by a transparent material with many small lines on it, called a diffraction grating.	H	K1 K8	3 4			
4. The student is able to produce interference patterns with two slits and a monochromatic light source.	H	P76	2			
5. The student is able to identify the regions hypothesized to be caused by constructive and destructive light interference, using the proper equipment.	H	P16	2 3			
6. The student is able to use the algebraic equations which describe interference of light.	H	P35	2 3			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.7 Interference (Cont.)						
7. The student is able to determine the wave length of a monochromatic light source in a physical situation.	H	P16	2 3			
8. The student knows ways in which to produce color patterns using a polychromatic light (e.g., thin films--such as air between two very flat pieces of glass, oil floating on water).	H	K8	4			
9. The student knows that the colored patterns produced by a thin film are due to the interference of light reflecting from the top surface and the bottom surface of the thin film.	U H	K8	4			
10. The student knows the theory of phase reversal and nonphase reversal of waves at appropriate surfaces.	H	G1 K2	4			
11. The student is able to measure very small distances by using thin film interference.	H	P16 P35	2			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.8 Diffraction						
1. The student knows that light bends from straight-line propagation under certain conditions.	I U H	K3 K8	4			
2. The student is able to produce a diffraction pattern.	I U H	P76	2 3			
3. The student knows that the size of the slit opening or the small object that is to be used to produce a large, clear diffraction pattern must be in the order of size of the wave length of light used.	I U H	K7	4			
4. The student is able to use the algebraic equations that have been developed to describe diffraction of light.	H	P35	2 3			
5. The student is able to use diffraction of light as a tool in determining small distances.	H	P16	2			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.9 Polarization						
1. The student knows that the effect of a polarizing material is to transmit only those waves which have their electric field (or equivalent magnetic field) vectors aligned on a certain direction.	U H	K7 K8	4			
2. The student knows that before polarization of light was observed, light was thought to be a longitudinal wave. (Polarization observations led to the theorizing that light was of a transverse wave nature.)	H	K3	4			
3. The student knows that plane polarized light vibrations are in a single plane and are perpendicular to the direction of propagation.	H	K3	3 4			
4. The student knows that light radiated from most sources is unpolarized.	H	K3	4			
5. The student is able to polarize light with polarizing materials.	H	P76	2 3		2.2.2	
6. The student knows that aligning two polarizing materials perpendicularly to one another will almost totally eliminate a beam of light.	H	K8	4			
7. The student knows situations where polarization occurs naturally (e.g., certain mineral crystals with certain nonmetallic reflection and refraction; in the absorption/scattering that occurs with atmospheric particles of light from the sun).	H	K6 K8	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.10 Photoelectric effect						
1. The student knows that when light illuminates certain materials they, in turn, emit electrons. (This is known as the photoelectric effect.)	U H	K2 K8	4			
2. The student knows that the rate at which electrons are emitted from an illuminated material is directly proportional to the intensity of the incident, illuminating light.	U H	K8	4			
3. The student knows that the energy of the emitted electrons from an illuminated material is independent of the intensity of the incident, illuminating light.	H	G2 K10	4			
4. The student knows that the energy of the emitted electrons from an illuminated material increases with the frequency of the incident, illuminating light.	H	K8	4			
5. The student knows that there is a characteristic frequency for each illuminated material below which electron emission will not occur.	H	K3	4			

5. Physics

5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.10 Photoelectric effect (Cont.)						
6. The student knows that for the frequencies of light which cause emission of electrons from materials, the energy of the emitted electrons is directly proportional to the frequency of the incident, illuminating light.	H	K8	4			
7. The student knows that the photoelectric effect demonstrates that light has (not only the characteristics of waves but also) the characteristics of particles.	H	K3	4		4.1.2.1 4.8	
8. The student knows that "particles" such as electrons and neutrons have been shown to have the characteristics of waves--they diffract and interfere.	H	K5	4		4.1.2.1 4.8	
9. The student knows that quantum theory was developed to explain the electron emission phenomenon.	H	K4	4			
10. The student knows that the quantum theory states that the energy transferred from light to matter occurs in discrete packets, photons, and the magnitude of transfer depends on the frequency of light.	H	G1 K2 K8	4			

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.10 Photoelectric effect (Cont.)						
11. The student knows that photons have characteristics similiar to other particles which have mass. (One observation is that light exerts pressure.)	H	K3	4 7			
12. The student knows the basic algebraic equation related to the photoelectric effect was developed by Max Plank and Albert Einstein.	H	K2 K6	3 4			(V) Respect for accomplishment of others

5. Physics
5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.11 Lasing effect						
1. The student knows that ordinary light sources are incoherent (photons have random phase as they leave the source).	H	K2 K3	4			
2. The student knows that light emitted from a laser is coherent (in phase).	H	K4	4			
3. The student knows that "laser" stands for "light amplification by stimulated emission of radiation."	H	K1 K2	3 4		2.2.3	
4. The student knows that "maser" is the name given to microwave sources of coherent radiation.	H	K1 K2	3 4			
5. The student knows that "maser" stands for "microwave amplification by stimulated emission of radiation."	H	K1	3 4		2.2.3	
6. The student knows there are different types of lasers.	H	K5	4			
7. The student knows some of the basic principles of lasers.	H	K2 K3	4			
8. The student knows that development of laser technology is relatively recent (e.g., micro-waves in phase were first produced in 1954, light waves in phase in 1960).	H	K4	4			(C)History of science (C)Technology
9. The student knows contributions of various scientists and organizations to laser research, development, and applications (e.g., Bell Telephone Labs).	H	K4	1			(C)History of scienc (C)Research (V)Cooperation (V)Respect for others

5. Physics

5.11 Light (electromagnetic radiation)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.11.11 Lasing effect (Cont.)						
10. The student knows current and planned practical applications of lasers.	H	K7	4 5			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12 Sound						
1. The student knows the location and use of print and nonprint materials related to sound (e.g., card catalog: "Sound," "Vibration," "Ultrasonics"; SUBJECT GUIDE TO BOOKS IN PRINT: "Sound," "Absorption of Sound," "Echo," "Ultrasonics," "Sound-Measurement"; READER'S GUIDE: "Sound," "Sound Perception"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Sound-Absorption," "Sound-Diffraction," "Sound-Scattering"; LEARNING DIRECTORY: "Sound, Harmonics," "Sound Transmission," "Sound, Frequency"; area and building audiovisual catalogs: "Sound").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.1 Characteristics						
1. The student knows that sound is caused by vibrating objects.	P I U H	K8	4			
2. The student knows that sound is a longitudinal wave disturbance traveling through a medium. (Sound does not travel through a vacuum.)	P I U H	K2	3 4		2.2.3	
3. The student knows that longitudinal waves are composed of "spread out" regions called rarefactions and "bunched up" regions called compressions.	U H	K3	3 4			
4. The student is able to produce sound by causing objects to vibrate.	P I U H	P76	2 7 8			
5. The student knows that sound, being a wave phenomenon, has the characteristics of waves.	H	K5	3 4			
6. The student knows the characteristics of sound waves (e.g., they have frequency, wave length, period, speed, intensity, rectilinear propagation--in a homogeneous medium).	H	K3	3 4			
7. The student knows that sound waves undergo reflection, refraction, interference, diffraction, etc.	H	K3	3 4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.1 Characteristics (Cont.)						
8. The student knows that sound (as a periodic wave phenomenon) cannot be transported by a medium when the wave length is small in relationship to the intermolecular spacing of the medium.	H	K8	2 3 4			
9. The student knows that sound is that region of all the compression/rarefaction type frequencies to which human ears are sensitive.	P I U H	K2	1 3 4 7			(V)Self knowledge
10. The student knows that there is a wide range of frequencies to which the ear is not sensitive.	P I U H	G2 K3	1 4 7			(C)Perception (V)Self knowledge
11. The student knows that compression/rarefaction waves having frequencies above the audible range of human beings are said to be ultrasonic.	U H	K2	3 4 7		2.2.3	
12. The student knows that those waves having frequencies below the audible range are said to be infrasonic or subsonic.	U H	K2	3 4 7		2.2.3	
13. The student knows ways in which sound waves may be transferred into visible waves (e.g., tuning fork in water, vibrating tuning fork initiating vibrations in another tuning fork).	P I U H	K3 K7	3 4 5 7			(C)Perception

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.1 Characteristics (Cont.)						
14. The student knows ways in which sound waves may be "seen" as longitudinal (e.g., straight metal rod with attached ball vibrating as end of rod is struck).	P I U H	K3 K7	3 4 5 7			(C)Perception
15. The student knows that the ear/brain system perceives sound.	P I U H	K7	1 4			(C)Perception (V)Self knowledge
16. The student knows commonly recognized properties of sound perceived by humans (e.g., loudness, pitch, quality).	P I U H	K3	1 3 4			(C)Perception (V)Self knowledge

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.2 Transmission of sound						
1. The student knows that most sounds reach the ear via air as a transmitting medium.	P I U H	K7	4			(C)Perception
2. The student knows the comparative properties of materials to transmit sound (e.g., solids transmit better than do liquids, liquids transmit better than do gases).	P I U H	K5	4			
3. The student is able to calculate the speed of sound through a vacuum.	U H	P35	2 3 7			(C)Measurement
4. The student knows that sound is not transmitted through a vacuum.	I U H	G1 K6 K7	4			
5. The student knows that the speed of sound transmission is related to properties of the medium such as temperature, density, and elasticity.	U H	K8	4			
6. The student knows the ways in which concepts related to transmission of sound can be applied in determining depths, distances, and types of materials (e.g., sonar measurement, determing rock types below the earth's surface).	U H	K7	3 4 5 7			
7. The student knows the relationship between principles of seismography and principles of sound transmission.	U H	K8	4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.3 Reflection and absorption of sound						
1. The student knows that sound can be reflected and absorbed.	P I	G2 K3	4			
2. The student knows that sound is better reflected from certain surface textures (hard, smooth) than from others (soft, irregular).	P I	K8	4 5			
3. The student knows that reflected sound can reinforce or interfere with the original sound.	I U H	K8	4 5			
4. The student knows that echoes are caused by sound striking an object and being reflected back.	P I	K8	4 5 7			
5. The student knows that absorbed sound is converted into another form of energy within the absorbing medium.	I U H	K3	4			
6. The student knows that sound is better absorbed in certain textures of substances (soft, irregular) than in other textures (smooth).	P I	K8	4 5 7			
7. The student knows that sound can be changed by absorption (muffled, deadened) and by reflection (echoed).	P I U	K2 K8	4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.4 Intensity (loudness)						
1. The student knows that loudness is the effect of intensity of sound on the ear.	I U H	K2 K8	4		2.1.1.1 2.2.3	(C)Perception
2. The student knows that sound can be detected by a variety of procedures, all of which involve the use of pressure sensitive instruments or materials.	U H	K7	4			
3. The student knows that intensity (loudness) of sound varies with the energy of the refractions and compressions in the medium through which the sound travels.	H	K8	4			
4. The student knows that the greater the intensity of sound, the greater the amplitude of the vibration.	H	K8	3 4			
5. The student knows that sound is produced and transported by vibrating molecules.	U H	K7 K8	4			
6. The student knows that intensity of sound is a measure of the rate at which energy is transported through an area perpendicular to the direction of propagation.	U H	K2	3 4			
7. The student knows that sound energy is absorbeo by materials due to intermolecular interactions.	U H	K8	4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.4 Intensity (loudness) (Cont.)						
8. The student knows that sound energy decreases in relationship to the distance from the source. (The sound energy is the inverse proportion to the square of the distance from the source.)	U H	K8	4 5			
9. The student knows that sound "loudness" decreases as one gets farther from the source.	P I U H	K8	4 5			
10. The student knows that sound intensity is measured in terms of "decibels" (based upon a logarithmic scale).	H	K2	3 4		2.2.3	(C)Measurement
11. The student knows that for a given frequency, the louder the sound, the greater the distance his ear drum vibrates back and forth as it detects the sound.	I U H	K8	4		2.1.1.1	(C)Perception
12. Tne student knows that loudness of a sound is dependent on the ear/brain perception of the sound.	I U H	K8	4 7			(C)Sound, perception
13. The student knows that sound of a high frequency can cause pain even though it may not be loud.	U H	K8	4 5 7			
14. The student knows that continued exposure to sounds of high intensity can be harmful to the ear system.	U H	K8	4 5			
15. The student knows ways that sound is amplified.	I U H	K7	3 4 5 7			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.5 Frequency (pitch)						
1. The student knows that sound has frequency.	U H	K3	4			
2. The student knows that the frequency of sound is inversely proportional to the wave lengths of sound for a given constant velocity.	U H	K2 K8	3 4			
3. The student knows that the velocity of sound is the product of frequency and wave length.	U H	K2 K8	3 4			
4. The student knows that pitch is the effect of frequency of sound on the ear.	I U H	K2 K8	3 4			
5. The student knows that the greater the frequency, the higher the pitch.	I U H	K8	4			
6. The student is able to distinguish different pitches of sound.	P I U H	P12 P33	2 3 5			
7. The student is able to classify sounds by different characteristics (e.g., loudness, pitch).	P I U H	P12 P33	2 3			
8. The student knows the ways in which the Doppler Effect is associated with sound (e.g., when a source of sound approaches the listener, the pitch increases; when the source of sound goes away from the listener, the pitch decreases).	I U H	G1 K3	3 4			
9. The student knows ways in which the Doppler Effect can be used to determine the relative motion of a source of sound.	I U H	K7	3 4 5			

5. Physics

5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.5 Frequency (pitch) (Cont.)						
10. The student knows that sound waves will interfere under appropriate conditions just as other waves do.	U H	K5	3 4			
11. The student knows that a beat frequency is the resulting frequency when two sound waves interfere.	U H	K8	3 4			
12. The student is able to produce a beat frequency.	I U H	P71 P78	3 4			
13. The student knows that resonance occurs when one vibrating object (or the air around it) causes another object to vibrate at its natural frequency.	I U H	K2 K8	3 4			
14. The student is able to produce resonance in an object.	I U H	P68 P71 P78	2 3 4			
15. The student knows that all objects can be forced to vibrate at frequencies other than their natural frequency.	I U H	G2 K3	4			
16. The student knows the principle of forced vibration as it applies to musical instruments.	I U H	G1 K3	3 4			
17. The student knows the difference between loudness and pitch.	I U H	K5	3 4			
18. The student knows that sound audible to humans has a frequency of between 16 and 20,000 cycles per second.	U H	G2 K6	3 4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.5 Frequency (pitch) (Cont.)						
19. The student knows that individuals vary in perceptions of sound frequency ranges.	I U H	K5	1 2 3 4			(C)Perception (V)Diversity
20. The student knows that the human ability to hear higher frequencies decreases with age.	I U H	K4	1 3 4			(C)Perception (V)Self knowledge
21. The student knows that some animals can detect frequencies of sound which are inaudible to humans.	I U H	K5	4			(C)Perception

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.6 Harmonic content of sound (quality)						
1. The student knows that when taut strings vibrate as a whole unit, they usually vibrate at their smallest natural frequency (fundamental frequency).	U H	K2 K8	3 4			
2. The student knows that as length of a vibrating string is increased, with other factors remaining constant, the fundamental frequency of the sound decreases.	U H	K2 K8	3 4			
3. The student knows that as the tension (tightness) of a vibrating string is increased, the frequency (pitch) of the sound produced increases, provided other factors remain constant.	P I U H	K2 K8	3 4			
4. The student knows that the greater the mass of a vibrating string, the lower is the frequency of the sound produced by it, if other factors remain constant.	P I U H	K2 K8	3 4			
5. The student is able to control the frequency of the sound produced by a vibrating string.	P I U H	P78	2 3 5 7 8			
6. The student knows that transverse waves in a string establish a standing wave pattern due to interference of the reflected waves.	U H	K8	3 4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.6 Harmonic content of sound (equality) (Cont.)						
7. The student knows that as a string vibrates in 2, 3, 4, or more segments, its frequency of vibration is also increased.	U H	K2 K8	3 4			
8. The student knows that harmonics produced by a vibration are those tones which have frequencies that are whole number multiples of the fundamental frequency.	H	K2 K8	3 4			
9. The student knows that musical tones and noises generally contain sounds of more than one frequency.	U H	K3	4			
10. The student knows that quality is the effect of the harmonic content of sound on the ear.	U H	K2	3 4			
11. The student knows that quality of a sound is dependent upon the number of harmonics and their relative intensities.	U H	K8	4			
12. The student knows that the composition of musical tones is dependent on the shape and the material of which the instrument is composed.	I U H	K8	3 4			
13. The student knows ways in which musical instruments are designed based upon the concepts of sound.	I U H	K3 K8	3 4			
14. The student knows the different types of musical instruments (e.g., percussion, string).	I U H	K5	4			

5. Physics
5.12 Sound

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.12.6 Harmonic content of sound (equality) (Cont.)						
15. The student is able to make musical instruments.	P I U H	P76	2 3 7 8			(V)Resourcefulness (V)Creativity (V)Aesthetic sensitivity
16. The student knows that noise is sound produced by matter vibrating in irregular vibrations.	U H	K2 K8	4		2.2.3	

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13 Electricity						
1. The student knows the location and use of print and nonprint materials related to electricity (e.g., card catalog: "Electricity"; SUBJECT GUIDE TO BOOKS IN PRINT: "Electricity," "Electricity, Static," "Electric Circuits," "Electric Currents"; READER'S GUIDE: "Electricity, Static," "Electric Capacitance," "Electric Currents"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Potential, Electric," "Electric Currents," "Electrostatics," "Electric Measurements"; LEARNING DIRECTORY: "Electricity," "Electric Current," "Electric Circuit"; area and building audiovisual catalogs: "Potential, Theory of," "Electric Currents," "Electric Circuits").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resource (V)Inquiry

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.1 Characteristics						
1. The student knows that objects can be charged electrically.	I U	K3	4			
2. The student knows that stationary electrical particles in equilibrium are called static electricity.	I U H	K2	3 4		2.2.3	
3. The student knows that matter is hypothesized to be made up of electrons, protons, and neutrons.	U H	G1 K3	4			(C)Matter
4. The student knows that positive and negative electrical charges are the two kinds of electrical charges which have been discovered.	I U H	K5	4			
5. The student knows that electrons are called negative, and protons are called positive charges; neutrons are said to be neutral because they have no charge.	U H	K3	3 4			
6. The student knows that the magnitude of negative charge of the electron is the same as the magnitude of positive charge of the proton.	H	K5	3 4			
7. The student knows that electrical charges cannot be created but are always conserved.	U H	G1 K3	4			
8. The student knows that electrical charges exert forces (called electromagnetic forces) on one another.	U H	K2 K3	3 4			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.1 Characteristics (Cont.)						
9. The student knows that electrical charges will move and can be caused to move continuously.	I U H	K3	4			
10. The student knows that current electricity is defined as the flow of electrical charges.	I U H	K2	3 4			
11. The student knows that energy can be in the form of electrical energy.	I U H	K5	4			(C)Energy
12. The student knows that other forms of energy can be converted to electrical energy.	I U H	K4	4			(C)Energy
13. The student knows that electrical energy can be converted to other forms of energy.	I U H	K4	4			
14. The student knows the historical development of electricity and its uses.	U H	K4	4 5 7			(C)Tools
15. The student knows that electricity is a major factor in our technological world.	I U H	K3 K8	1 3 4			(C)Tools (V)Productivity
16. The student knows uses of electricity.	P I U H	K7	3 4 5			(C)Tools
17. The student knows ways in which electrical energy is converted to other forms of energy.	P I U H	K7	2 3 4 5			(C)Tools

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.2 Static electricity (electrostatics)						
1. The student knows methods by which objects may be charged (e.g., friction, contact, conduction).	U H	K8	3 4			
2. The student knows that an electrically charged object is one which has unequal numbers of positive and negative electrical charges.	U H	K2	3 4		2.2.3	
3. The student knows proper methods to charge objects electrically.	I U H	K7	3 4			
4. The student knows that like charges repel and unlike charges attract.	I U H	G1 K3	4			
5. The student knows reasons why a charged object can attract other materials which are not charged.	U H	K8	4			
6. The student knows that an electroscope is used to observe and measure the effects of electrical charges.	I U H	K7	3 4			
7. The student knows that electrification (the process of establishing an electrical charge on an object) is generally accomplished by a transfer of electrons.	I U H	K2 K7	3 4			
8. The student knows that conductors are materials through which electrical charges travel (are transferred) easily.	P I U H	K2	3 4		2.2.3	

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.2 Static electricity (electrostatics) (Cont.)						
9. The student knows that an object will retain an electrical charge only if it is insulated from all other objects.	I U H	K3 K6	3 4			
10. The student knows that electrical charges always tend to become neutralized (charged objects tend to become uncharged).	I U H	K4	4			
11. The student knows that the amount of electrical charge is the difference between the number of positive and negative electrical charges on the object. (The unit of charge, one coulomb, equals 6.25 x 10^{18} electrons or protons.)	U H	K2	3 4		2.2.3	
12. The student knows that static electricity causes lightning storms.	P I U H	K8	4 5 7			
13. The student knows examples of static electricity in the environment.	P I U H	K3	4 7			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.3 Electrical forces						
1. The student knows that the force between two electrically charged objects is directly proportional to the product of the number of excess charges on each object and inversely proportional to the square of the distance between them (Coulomb's Law).	H	G1 K2	3 4			
2. The student knows that an electrical field exists in a region if an electrostatic force acts on an electrical charge brought into the region.	U H	K8	4			
3. The student knows that electrostatic lines of force are imaginary constructs used to conceptualize electric fields.	H	K7	3 4			
4. The student knows the established rules for electrostatic lines of force.	U H	K2	3 4			
5. The student knows that the electric field intensity is the force (unit charge) in a unit area of an electric field.	H	K2	3 4			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.4 Potential difference						
1. The student knows that work is done on the charges in bringing together two like charges or in moving two unlike charges apart. (Work is done by the charges if the direction is reversed.)	H	K2 K8	3 4			
2. The student knows that an electric charge is acted upon by a force in an electric field and, if it moves in the direction of that force, work is done by the electric field.	H	K8	4			
3. The student knows units of electrical measurement (e.g., volts, amps, watts).	I U H	K1 K2	3 4		2.2.3	
4. The student knows that two points in an electric field are said to be at different electrical potential if work is expended as a charge moves from one point to the other.	H	K6 K8	3 4			
5. The student knows that electrical potential is defined as the work done per unit of electric charge as the charge is moved from one point to another point in an electric field.	H	K2	3 4			
6. The student knows that the unit of potential difference is one volt.	I U H	K2	3 4		2.2.3	

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.4 Potential difference (Cont.)						
7. The student knows that voltage is defined as the potential difference between two points in an electric field such that one joule of work is required to move a charge of one coulomb between these points.	U H	K2	3 4		2.2.3	
8. The student knows the potential gradient is defined as the potential difference per unit distance in the direction of greatest difference. (Potential gradient is the same as electric field.)	H	K2	3 4		2.2.3	
9. The student knows that "grounded" means electrically connected to some large object such as a chassis or the earth so as to make the potential difference to that large object zero.	I U H	K2	3 4 7		2.2.3	
10. The student is able to ground a charged object with the earth.	I U H	P63	2 3 7			
11. The student knows the rules that have been established to explain the distribution of charges in a region.	U H	K2	3 4			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.5 Capacitance						
1. The student knows that opposite electrical charges will remain fixed on conducting plates if the plates are insulated from one another and from their surroundings.	U H	K3 K6	4			
2. The student knows that a device which holds opposite electrical charges is called a capacitor.	I U H	K2 K7	3 4		2.2.3	
3. The student knows that the amount of charge on either capacitor plate is proportional to the voltage applied.	U H	K8	4			
4. The student knows that the farad is the unit of capacitance.	U H	K2	3 4		2.2.3	
5. The student knows that capacitance is defined as a charge of one coulomb on a capacitor with a potential difference of one volt between the plates.	H	K2	3 4		2.2.3	
6. The student knows that the insulating material between capacitor plates is called a dielectric.	U H	K2	3 4		2.2.3	
7. The student knows that capacitors may be connected together to attain different capacitances.	U H	K7	4 7			
8. The student knows ways in which capacitors are used in many electric circuits in electrical instruments and appliances.	U H	K7	3 4 5 7			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.5 Capacitance (Cont.)						
9. The student knows that capacitors connected in series are connected in such a way that it is possible to proceed along only one path from one point in the system to another point.	U H	K3 K7	4			
10. The student knows that capacitors connected in parallel are connected in such a way that it is possible to proceed along several different paths when going from one point in the system to another.	U H	K3 K7	4			
11. The student knows that the reciprocal of the total capacitance in a series combination is the sum of the reciprocals of the individual capacitances.	H	K2	3 4			
12. The student knows that the total capacitance in a parallel combination is the sum of the individual capacitances.	U H	K2	3 4		2.2.3	
13. The student is able to calculate the total capacitance in either series or parallel combinations.	H	P35	2 3			
14. The student is able to determine the capacitance of a capacitor from the color code on the capacitor.	U H	P41	2 3 5 7			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.5 Capacitance (Cont.)						
15. The student knows the effect achieved by putting capacitors into electric circuits.	U H	K8	4 5 7			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.6 Electric current						
1. The student knows that charges will move through a conductor.	I U H	G2 K3	4			
2. The student is able to cause charges to move to or from a conductor.	I U H	P35	2 3 5			
3. The student knows that if a conductor is connected between a supply of electric charges and another conducting point, which is at a different potential, the charges (electrons) will flow from the lower to the higher region of potential.	U H	K3 K8	4			
4. The student knows that the time rate of flow of electric charges is called electric current.	H	K2	3 4		2.2.3	
5. The student knows that an ampere is a unit of electric current.	I U H	K2	3 4		2.2.3	
6. The student knows that the ampere is defined as one coulomb of charge passing a point in one second.	U H	K2	3 4		2.2.3	
7. The student knows that electric current in a wire is electron movement with many collisions occuring between the electrons and the fixed particles.	U H	K2 K3	3 4			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.6 Electric current (Cont.)						
8. The student knows that some materials conduct electric current easily and are called conductors.	I U H	K2 K3	3 4 7			
9. The student knows that some materials do not conduct electric current easily and are called insulators.	I U H	K2 K3	3 4			
10. The student knows that electrical charges will move more easily in some solid materials than in others.	I U H	K3	4			
11. The student knows the relationship between the conductivity of a solid material and the binding of electrons to the nuclei of its atoms.	U H	K8	4			
12. The student knows that resistance is the opposition to electric current and is measured in units of "ohms."	U H	K2	3 4		2.2.3	
13. The student knows that metals are generally better conductors than other solids.	I U H	K3 K5	4 7			
14. The student knows that some liquids, called electrolytes, are better conductors than are other liquids, called nonelectrolytes.	U H	K2 K3 K5	3 4			
15. The student knows that nonionized gases are poor conductors of electric current.	U H	K3	3 4			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.6 Electric current (Cont.)						
16. The student knows that an ion is an atom or a group of atoms having an unbalanced electrostatic charge.	U H	K2	3 4			
17. The student knows sources that can supply electric charges over an extended length of time (e.g., chemical, photoelectric, thermoelectric, piezoelectric, electromagentic).	U H	K3 K6	4 7			
18. The student knows the ways in which different sources produce electricity.	I U H	K7 K8	4 5 7			
19. The student knows that batteries (or cells) are the name given to the chemical sources of electricity.	P I U H	K1 K2	3 4		2.2.3	
20. The student knows that the emf of a source of electric charges is the energy per unit charge supplied.	U H	K2	3 4		2.2.3	
21. The student knows that emf is measured in volts.	I U H	K2	3 4			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.7 Electric circuits						
1. The student knows that a circuit is a closed loop consisting of a source of electric charges and a conductor.	P I U H	K2 K3	3 4			
2. The student knows that an electrical circuit is a system of batteries (or other power source) and wires with bulbs, motors, and/or other circuit elements.	P I U H	K2 K3	3 4 7		2.2.3	
3. The student knows that a closed circuit is a circuit with a complete path of wires and electrical devices linked to the power source.	I U H	K2 K3	3 4		2.2.3	
4. The student knows ways to test for a closed electric circuit.	I U H	K7	3 4 5 7			
5. The student knows that an open circuit is an incomplete path of wires and electrical devices connected to the power source.	I U H	K2 K3	3 4		2.2.3	
6. The student knows the symbols for many common electric components.	I U H	K2	3 4			
7. The student is able to diagram circuits.	I U H	P31 P76	2 3			
8. The student is able to read a circuit diagram.	I U H	P41	2 3 7			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.7 Electric circuits (Cont.)						
9. The student knows that a complete circuit is almost always necessary for electricity to be used.	I U H	K3 K6	3 4 7			
10. The student knows a series circuit is one in which the components are connected in such a way that it is possible to proceed along only one path from one point in the circuit to another point.	I U H	K3 K7	3 4			
11. The student knows that in a parallel circuit it is possible to proceed along several different paths when going from one point in the circuit to another point.	I U H	K3 K7	3 4			
12. The student is able to determine if a circuit is a parallel or series.	I U H	P47	2 3 7			
13. The student is able to construct series and parallel circuits.	I U H	P67	2 3 7 8			(V)Resourcefulness
14. The student knows that the current is often proportional to the emf across a point of a circuit.	H	K3	3 4			
15. The student knows that resistance is the reciprocal of the constant of proportionality between those points across which the emf exists (Ohm's Law: $I = \frac{E}{R}$).	H	G1 K2	3 4		2.2.3	

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.7 Electric circuits (Cont.)						
16. The student knows that current in a segment is often non-proportional to the emf across that segment (non-Ohmic).	H	K3	4			
17. The student knows that electrical conductance is a measure of the ease with which electrical charges move in a material.	U H	K2	3 4		2.2.3	
18. The student knows that electrical resistance is the measurement of the opposition to movement of electrical charges in the material.	U H	K2	3 4		2.2.3	
19. The student knows that the unit of electrical resistance is the ohm and the unit of electrical conductance is the mho (they are reciprocals of each other).	U H	K2	3 4		2.2.3	
20. The student is able to calculate the unknown factor in Ohm's Law when given the other two factors.	H	P35	2 3			
21. The student knows a voltmeter is used to measure the potential difference (emf) between two points.	I U H	K7	3 4			
22. The student knows that an ammeter is used to measure the current at a point in a circuit.	U H	K7	3 4			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.7 Electric circuits (Cont.)						
23. The student is able to use both the ammeter and the voltmeter to make electrical measurements within a circuit.	U H	P47 P63	2 3 7			
24. The student knows that in a series d.c. circuit the current is constant throughout; the total resistance is the sum of the individual resistances; and the sum of the potential differences across several components gives the total potential difference across all those components (if no changing magnetic field is present).	H	K3 K7	3 4			
25. The student knows that in a parallel arrangement the potential difference is the same across each component as that for the whole arrangement; the reciprocal of the total resistance is equal to the sum of the reciprocals of the individual resistances; and the total current is equal to the sum of the currents through the individual components.	H	K3 K7	3 4			
26. The student knows that resistances of resistors are dependent upon their temperature, length, cross-sectional area, and nature of composition.	H	K8	4			

5. Physics

5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.7 Electric circuits (Cont.)						
27. The student is able to determine the resistance of a resistor from the color code on the resistor.	U H	P41	2 3 7			
28. The student is able to use a voltmeter and an ammeter to determine the resistance of a component.	H	P47 P63	2 3 5 7			
29. The student is able to use a Wheatstone bridge method to determine resistances.	H	P47 P63	2 3			
30. The student knows that different components of an electrical circuit may have different resistances.	H	K3 K5	4			
31. The student knows that some parts of an electrical circuit convert more electricity to thermal energy than others do.	H	K3 K5	4			
32. The student knows causes of a short circuit.	I U H	K8	3 4			
33. The student knows the problems caused by a short circuit.	I U H	K8	4			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.8 Electrical energy						
1. The student knows that work is done in forming a source of electrical energy such as a battery.	I U H	K3 K8	4			
2. The student knows that energy is converted or dissipated as an electric source does work in causing electrical charges to move through a potential difference.	I U H	K3 K8	4			
3. The student knows that the components of a circuit convert electrical energy to other forms of energy.	P I U H	K7	4			
4. The student is able to use models to illustrate energy transfer in electric circuits.	I U H	P66	2 3			
5. The student knows that in all circuit components varying amounts of electrical energy is converted to energy and dissipated.	I U H	K4	4			
6. The student knows that the temperature of electrical components in a circuit is generally raised above the surroundings while current flows in the circuit.	U H	K3 K8	4 5			
7. The student knows that one joule of energy is dissipated or converted in an electric circuit when one coulomb of charge is moved through a potential difference (V) of one volt in one second (W = VIt).	H	K2	3 4			

5. Physics
5.13 Electricity

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.13.8 Electrical energy (Cont.)						
8. The student knows Joule's Law for the conversion of electrical energy to thermal energy: (the heat (H) developed in a conductor is directly proportional to the resistance of the conductor (R), the square of the current (I), and the time (t) the current is maintained-- $H = I^2Rt$).	H	G1 K2	3 4			
9. The student knows that electrical power is the time rate at which electric energy is expended in a component ($P = w/t$).	I U H	K2	3 4			
10. The student knows the unit of power is the watt which is defined as one joule per second.	I U H	K1 K2	3 4		2.2.3	
11. The student knows that electrical energy is purchased in units of kilowatt hours.	I U H	G2 K3	3 4 5			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14 Magnetism						
1. The student knows the location and use of print and nonprint materials related to magnetism (e.g., card catalog: "Magnetism," "Electromagnetism," "Electric Generators"; SUBJECT GUIDE TO BOOKS IN PRINT: "Magnetism," "Electromagnetic Fields," "Magnetic Storms," "Domain Structure"; READER'S GUIDE: "Magnetism, Terrestrial," "Magnetic Fields," "Domain Structure"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Magnetism," "Electromagnets," "Magnetic Resonance"; LEARNING DIRECTORY: "Magnetic Field," "Magnetism," "Alternating Current"; area and building audiovisual catalogs: "Magnetism," "Electromagnetism").	P I U H	K6	3		2.1.1.2	(C)Resources (V)Inquiry

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.1 Characteristics						
1. The student knows that objects may interact without physical contact (e.g., magnets).	P I U H	G2 K7	4			
2. The student knows the property of some metals to attract some other metals (e.g., iron, cobalt, nickel) as forms of magnetism.	P I U H	K3	4			
3. The student knows that natural magnets exist in the form of a magnetic iron ore called magnetite.	I U H	K2 K3	3 4			
4. The student knows differences between objects that do and that do not interact with magnets.	P I U H	K5	4			
5. The student knows that some metals are not noticeably attracted by magnets.	P I U H	K3	4			
6. The student knows that materials which readily exhibit magnetic properties or are readily attracted by magnets are called ferromagnetic materials (iron, some steel, nickel, cobalt).	I U H	K2 K3	3 4		2.2.3	
7. The student knows that materials which are attracted very weakly toward a magnet are called paramagnetic.	I U H	K2	3 4		2.2.3	
8. The student knows that materials which are very slightly repelled by magnets are called diamagnetic.	U H	K2 K3	3 4		2.2.3	

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.1 Characteristics (Cont.)						
9. The student knows ways to identify permanent and temporary magnets.	I U H	K5	3 4			
10. The student knows that magnets have two poles: a north seeking pole and a south seeking pole (e.g., the north seeking pole of a magnet is the pole which will point toward the earth's north magnetic pole if the magnet is suspended from a string at its center).	P I U H	K3	4			
11. The student knows conditions under which magnets will attract or repel other magnets.	I U H	K7 K8	4 7			
12. The student knows that like magnetic poles repel and unlike magnetic poles attract.	P I U H	K3	4			
13. The student is able to determine the nature of the poles of a magnet.	P I U H	P47	2 3			
14. The student knows that the earth acts as a giant magnet.	I U H	K5	4 7			
15. The student knows the earth has a north magnetic pole and south magnetic pole which are not at the true north and south poles of the earth.	I U H	K3	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.1 Characteristics (Cont.)						
16. The student knows that there is a magnetic field around any electric current.	U H	K3 K6 K8	4			
17. The student knows ways in which an electromagnet can be constructed.	P I U H	K7	3 4			
18. The student knows the ways in which magnets are used in electrical instruments.	I U H	K7	4 5 7			
19. The student knows that magnets have magnetic fields around them.	P I U H	K3 K6 K8	4			
20. The student knows the conventional method of viewing the magnetic fields: lines of force travel within the magnet from the south seeking pole to the north seeking pole and outside the magnet from the north seeking pole to the south seeking pole.	U H	K2	3 4			
21. The student knows that a wire moved through a magnetic field produces an emf in the wire and a current if the wire is a complete circuit.	U H	K8	4			(C)Tools
22. The student knows electrical devices can convert mechanical energy to electrical energy (generators) and electrical energy to mechanical energy (motors).	I U H	K4 K7	4 7			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.1 Characteristics (Cont.)						
23. The student knows that electricity produced by generators can be either alternating or direct current.	U H	K5	4			
24. The student knows that electronic devices which control and convert electricity are the basis of much of electrical technology (e.g., radios, televisions, computers, oscilloscopes).	I U H	K7	4 7			(C)Tools (C)Technology

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.2 Magnetic domains						
1. The student knows that magnetism is defined as the part of the interactions between charged particles related to motions of those particles.	I U H	K2	3 4		2.2.3	
2. The student knows that a piece of ferromagnetic material can be magnetized by rubbing it with or bringing it near another magnet.	P I U H	K7 K8	3 4 7			
3. The student is able to magnetize a piece of ferromagnetic material.	P I U H	P65 P76	2 3 7			
4. The student knows that striking a magnet against a hard surface may cause it to demagnetize.	P I U H	K8	4 7			
5. The student is able to cause a magnet to demagnetize.	P I U H	P65 P76	2 3 7			
6. The student knows that electrostatics is defined as the part of the magnetic interaction between charged particles that would exist in the absence of motion.	U H	K2	3 4		2.2.3	
7. The student knows that electron orbital "motion" and spin give rise to magnetism in solids.	U H	K8	4			
8. The student knows ferromagnetism is the result of whole regions of atomic "magnets" being aligned in the same direction.	U H	K8	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.2 Magnetic domains (Cont.)						
9. The student knows paramagnetism is the tendency for adjacent atoms to align magnetically the same directions.	U H	K2	3 4		2.2.3	
10. The student knows diamagnetism is the tendency for atoms to align in opposite directions.	U H	K2	3 4		2.2.3	
11. The student knows that the magnetic domain of a substance is a microscopic region made up of a group of atoms which are magnetically aligned in the same direction. (This alignment is always present as long as the material remains ferromagnetic.)	U H	K2 K6	3 4			
12. The student knows that all known ferromagnets can be converted to paramagnets by heating above a critical temperature called the "Curie point."	U H	K7 K8	3 4			
13. The student knows that when a ferromagnetic material is "magnetized," the domains shift a little to cause greater numbers to be aligned in one direction than the numbers in other directions.	U H	K8	4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.3 Magnetic forces						
1. The student knows that magnets fully attract all paramagnetic materials.	I U H	K3	4			
2. The student knows that magnets repel very feebly all diamagnetic materials.	I U H	K3	4			
3. The student knows that like poles of magnets repel and unlike poles attract in accordance with an inverse square law.	I U H	G1 K3	4			
4. The student knows that the force between the poles of magnets is directly proportional to the product of the strengths of the poles and inversely proportional to the square of the distance between them.	H	K2	3 4			
5. The student knows that a magnetic field is said to exist in a region in which a magnetic pole is acted upon by a magnetic force.	U H	K2 K6	3 4			
6. The student knows that the magnetic field lines--analogous to electric lines of force--are lines of flux.	I U H	K2	3 4		2.2.3	

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.3 Magnetic forces (Cont.)						
7. The student knows that the magnetic field intensity is determined by the magnetic flux density, which is the number of flux lines per unit area in a magnetic field.	U H	K2 K7	3 4			
8. The student knows that the choice of position of a given line of flux is entirely arbitrary and has no physical significance--only the density and direction of flux lines are meaningful.	H	K2	3 4			
9. The student knows that flux density is expressed in webers per meter squared. (Flux is measured in webers.)	H	K2	3 4			
10. The student knows that induced magnetism is the magnetic field caused by a changing electric field in a region of space.	U H	K2 K8	3 4			
11. The student knows that during the subjection of a ferromagnetic material to a magnetizing force, the magnetization lags behind the magnetizing force; this lagging is called hysteresis.	H	K2 K10	3 4		2.2.3	

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.4 The earth's magnetism						
1. The student knows ways in which the earth can be compared to a giant magnet.	I U H	G2 K3 K5	4			
2. The student knows that the compass is used to determine direction.	P I U H	K7	4			(C)Tools
3. The student knows that a compass needle is a small magnet on a pivot.	P I U H	K2	4			
4. The student is able to use a compass.	P I U H	P16	3 4 5			(C)Tools
5. The student knows that the angle of declination at a point in the northern hemisphere is the angle the compass varies from true north.	I U H	K2	3 4			
6. The student knows that the magnetic equator is a line around the earth at which a magnet held horizontally does not deviate from the horizontal.	I U H	K2	3 4		2.2.3	
7. The student knows that the angle of inclination is the angle at which a horizontally placed magnet will dip.	I U H	K2	3 4		2.2.3	

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.4 The earth's magnetism (Cont.)						
8. The student is able to determine the angle of inclination at a point on the earth.	I U H	P35	2 3 7			
9. The student knows the magnetic poles of the earth have reversed several times throughout the earth's history.	I U H	K4	4			
10. The student knows that evidence of magnetic reversals remains in the earth's rocks.	I U H	K3 K8	4			
11. The student knows that evidence of past magnetic reversals provides the basis for a dating system used in studies of ocean floor spreading.	I U H	K7	3 4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.5 Electromagnetism						
1. The student knows that a magnetic field exists in the region in which electrical charges move.	I U H	K3 K6 K8	4			
2. The student knows that the direction of the magnetic field around a current-carrying wire is dependent on the direction of the current.	U H	K8	4			
3. The student is able to determine the direction of the magnetic field surrounding a current-carrying conductor.	U H	P45	2 3			
4. The student knows a solenoid is a hollow coil of conducting wire, usually of one set of turns of wire.	I U H	K2	3 4		2.2.3	
5. The student knows that a solenoid with a soft iron rod inserted in the core is an electromagnet when the current is flowing.	I U H	G2 K3	4			
6. The student knows that the strength of an electromagnet is dependent upon the number of conductor turns and the amount of current in the conductor.	I U H	K8	4			
7. The student knows the ways in which to make an electromagnet.	I U H	K7	3 4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.5 Electromagnetism (Cont.)						
8. The student knows examples of practical applications of electromagnets.	I U H	K7	4 5 7			(C)Tools (C)Technology
9. The student knows that when an electric charge moves perpendicularly into a magnetic field it will be deflected by a force in a direction perpendicular to both its own motion and the direction of the magnetic field.	U H	K8	4			
10. The student knows that small particle accelerators (such as the betatron and cyclotron) take advantage of the right angle movement of a charged particle in a magnetic field.	H	K7 K8	4			
11. The student knows that the force on a current-carrying conductor is proportional to the magnetic flux density, the current in the conductor, and the length of the wire in the magnetic field.	H	K8	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.6 Electromagnetic induction						
1. The student knows that when a conductor is moved perpendicularly to a magnetic field an emf is induced in it, and if it is a part of a circuit, current is induced in the circuit.	U H	K3 K8	3 4			
2. The student knows that the direction of the induced current is related to the direction of motion of the conductor in the magnetic field.	H	K3 K8	4			
3. The student knows that the maximum induction of emf or current occurs when the motions of the conductor are perpendicular to the magnetic flux lines.	H	K6 K8	4			
4. The student knows that if the magnetic field is in the same direction as the motion of the conductor, no emf is induced and no current is produced.	H	K8	4			
5. The student knows that the magnitude of the induced emf and/or of the induced current in the circuit is proportional to the rate at which the flux linked by the conductor changes.	H	K3	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.6 Electromagnetic induction (Cont.)						
6. The student knows that in each turn of a coiled conductor the emf (E) that is induced will be directly proportional to the time (t) rate of change of the magnetic flux $(\Delta \phi)$ encircled by each coil.	H	K3 K8	3 4			
7. The student knows that algebraic signs, positive and negative, indicate the relative polarity of the induced emf.	H	K2	3 4			
8. The student knows that a conductor moving in a magnetic field will have an induced emf in it but a current will be induced only if the conductor is part of a complete circuit.	H	K3 K6 K8	3 4			
9. The student knows that when an emf is induced in a conductor, not a part of a circuit, an electric field is established.	H	K3 K8	3 4			
10. The student knows that when an electric charge moves perpendicular to the magnetic field, the force (F) on the charge is also perpendicular to the motion and the field, and the direction of the force depends on the relative directions of the field and the motion.	H	K3 K8	3 4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.6 Electromagnetic induction (Cont.)						
11. The student knows hand rules that have been established to relate the direction of the charge movement, the magnetic field, and the force exerted.	H	K2	3 4			
12. The student knows the force exerted on the moving charge through a magnetic field is directly proportional to the product of the magnetic flux density (B), the quantity of charge (Q), and the relative velocity of movement (v). (If the direction of v and B are mutually perpendicular then $F = QvB$.)	H	K2 K3 K8	3 4			
13. The student knows that when an electric current is induced in a circuit due to a portion of the circuit moving in a magnetic field, a force will arise on the wire in opposition to its motion.	H	K3 K8	3 4			
14. The student knows that an induced current is in such a direction that its magnetic effect will oppose the change causing the induced current (Lenz's Law).	H	G1 K8	3 4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.7 Generators and motors						
1. The student knows that a generator is a device which converts mechanical energy to electrical energy.	U H	K2 K7	3 4			(C)Tools
2. The student knows the ways in which the operation of a generator relates to the principles of electromagnet induction.	U H	K7	3 4			
3. The student knows the means by which a generator produces alternating current.	U H	K7 K8	3 4			
4. The student knows that alternating current is current which has a particular direction for one short period of time and an opposite direction for another short period of time. (Each period of time is 1/60 of a second in most U. S. house current.)	H	K2	3 4		2.2.3	
5. The student knows that a generator induces an emf (voltage) which alternates.	H	K3 K8	4			
6. The student knows the magnitudes of both the induced current and the induced emf from a generator vary sinusoidally (a sine wave function) with time, assuming that the conducting coil (armature) rotates at a constant rate through a magnetic field having a uniform flux density.	H	K8 K10	4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.7 Generators and motors (Cont.)						
7. The student knows that the induced current in the external circuit of a simple generator alternates in phase with the induced emf.	U H	K8	4			
8. The student knows that generators can be made to produce direct current instead of alternating current.	U H	K3 K8	4			
9. The student knows that direct current pulsates between a zero value and a maximum value in the simplest d.c. generators.	H	K3 K4	4			
10. The student knows the parts and purposes of direct and alternating current generators.	U H	K3 K7	4			
11. The student knows that a motor is a device for converting electric energy to mechanical energy.	U H	K2 K7	3 4			(C)Machines
12. The student knows the ways in which the operation of a motor relates to the principles of electromagnetic induction	U H	K7	4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.7 Generators and motors (Cont.)						
13. The student knows that the motor effect is the converse (opposite) of the generator effect.	U H	K5	4			
14. The student knows the ways in which the motor effect is produced in a mechanical device. (Current is supplied to a coiled conductor--armature--which is within a magnetic field.)	H	K7 K8	4			(C)Machines
15. The student knows the means by which an electric current causes a motor to convert electric energy to mechanical energy.	H	K7 K8	4			
16. The student knows that a motor in operation also acts as a generator.	H	K7	4			
17. The student knows that the back emf is the emf produced by a motor in operation.	H	K3	4		2.2.3	
18. The student knows that the back emf opposes the emf being applied to the armature.	H	K3	4			
19. The student knows differences between direct current motors and alternating current motors.	H	K2 K5	3 4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.7 Generators and motors (Cont.)						
20. The student knows the parts and their purposes of direct current and alternating current motors.	H	K3 K7	4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.8 Inductance						
1. The student knows that mutual conductance is defined as two circuits of coiled conductors arranged in such a way that a change in the magnitude of the current in one causes an induced emf in the other.	H	K2 K8	3 4			
2. The student knows that mutual inductance is explained by the principles of electromagnetic induction.	H	G1 K7	3 4			
3. The student knows that the emf (E) induced in one coil is proportional to the time rate change of the current (I) in the other coil, and the constant of proportionality is defined as the mutual inductance (u). $E = -u \frac{\Delta I}{\Delta t}$	H	K2	3 4			
4. The student knows that when two coils of wires are inserted one within the other, the coil connected to the current source is the primary coil, and the coil connected to the external circuit is called the secondary coil.	H	K1 K2	3 4			
5. The student knows that the "henry" (h) is the unit of measure for inductance.	H	K1 K2	3 4		2.2.3	

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.8 Inductance (Cont.)						
6. The student knows that one henry is the mutual inductance between two circuits if one volt of emf is induced in the secondary coil when the rate of current change is one ampere per second in the primary coil.	H	K2	3 4			
7. The student knows that placing a soft iron core in the primary coil greatly increases the magnetic flux density and the induced emf.	H	K8	3 4			
8. The student knows that a coil will induce in itself a counteracting emf because of a variation in its current (self-inductance).	H	K3 K8	4			
9. The student knows that the counter emf (E) is proportional to the time rate change in current (I) and the constant of proportionality is defined as the self-inductance (L). $E = -L \frac{I}{t}$	H	K2 K8	3 4			
10. The student knows that the self-inductance of a coil is proportional to the number of turns of the conductor in the coil, the diameter of the coil, the length of the coil, and the nature of the core of the coil.	H	K3 K8	4			
11. The student knows that inductor is the name commonly given to a coil.	H	K1	3		2.2.3	

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.8 Inductance (Cont.)						
12. The student knows that inductors can be connected into electrical circuits in parallel and series combinations.	H	K3	3 4			
13. The student knows that the total inductance of inductors connected in series is equal in magnitude to the sum of the individual inductances.	H	K2	3 4			
14. The student knows that for inductors connected in parallel, the reciprocal of the total inductance is equal in magnitude to the sum of the reciprocals of the separate inductances.	H	K2	3 4			
15. The student knows that a transformer is a mechanical device consisting of two coils wound on the same core but electrically insulated from one another.	H	K2	3 4			
16. The student knows that transformers transfer electrical energy from the primary coil to the secondary coil by means of the magnetic flux in the common core.	H	K3 K7	4			
17. The student knows the difference between a step-up transformer and a step-down transformer.	H	K5	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.8 Inductance (Cont.)						
18. The student knows that in transformers very little electrical energy is lost through conversion to heat.	H	K3	4			
19. The student knows the relationship between the magnitudes of voltages and currents in transformers.	H	K8	4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.9 Alternating current (AC) circuits						
1. The student knows that the alternating current and alternating voltage in an AC circuit, which contains only resistance, are in phase.	H	K3	4			
2. The student knows that the instantaneous electrical power in an AC circuit is equal to the product of the instantaneous current and instantaneous voltage.	H	K2 K3 K8	3 4			
3. The student knows that the average values of the alternating current and voltage (both sinusoidal functions) are both zero.	H	K2	3 4			
4. The student knows that the effective value of alternating current is taken in terms of the heating effect it causes in a circuit.	H	K2 K8	3 4			
5. The student knows that effective values of current and voltage of alternating electricity are the root mean square values.	H	K2	3 4			

5. Physics

5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.9 Alternating current (AC) circuits (Cont.)						
6. The student knows that root mean square (rms) values are the square roots of the means of the squares of the instaneous values.	H	K2	3 4		2.2.3	
7. The student is able to calculate the rms values of both current and voltage.	H	P35	2 3			
8. The student knows that when the AC voltage and current are in phase, the average power of an AC circuit is the product of the rms values of voltage and current.	H	K2	3 4			
9. The student knows that AC electricalmeters usually measure effective values of current and voltage.	H	K3 K7	3 4			
10. The student is able to use AC meters to measure current and voltage.	H	P35 P41	2 3			
11. The student knows that in an AC circuit, containing only an inductor, the current and voltage will be 90° out of phase with the current lagging the voltage.	H	K3	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.9 Alternating current (AC) circuits (Cont.)						
12. The student knows that an inductor has some resistance (the resistance of the wire of which it is constructed).	H	K3	4			
13. The student knows that reactance is nonresistive opposition to the current which occurs in AC currents.	H	K2	3 4		2.2.3	
14. The student knows that the unit of measure of reactance is the ohm.	H	K2	3 4		2.2.3	
15. The student knows that the inductive reactance (X_L) of a coil is directly proportional to the frequency of the current in the circuit and to its inductance (L). ($X_L = 2\pi fL$)	H	K2 K8	3 4			
16. The student knows that the impedance is the joint opposition of reactance and resistance in an AC circuit.	H	K2	3 4		2.2.3	
17. The student knows that capacitors may be put into AC circuits.	H	K7	4			
18. The student knows that in an AC circuit with only capacitance, the voltage and current are 90° out of phase with each other and the current leads the voltage.	H	K3	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.9 Alternating current (AC) circuits (Cont.)						
19. The student knows that a capacitor in an AC circuit causes reactance.	H	K8	3 4			
20. The student knows that the capacitive reactance in an AC circuit is inversely proportional to the frequency of the circuit current and to capacitance. ($X_c = \frac{1}{2\pi fc}$)	H	K2 K8	3 4			
21. The student knows that capacitors inductors, and resistors can be connected in series, parallel, or both series and parallel combinations.	H	K3 K6	4			
22. The student knows that for electrical devices to transfer energy most efficiently in AC circuits, the impedances often must be matched.	H	K7	3 4			
23. The student is able to determine the necessary impedance match for a device such as a loud speaker.	H	P44 P63	2 3			
24. The student knows that the impedance of a circuit depends on the frequency of the current (inversely for capacitive reactance and directly for inductive reactance), and therefore, there might be a frequency at which the current is max-	H	K8	3 4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.9 Alternating current (AC) circuits (Cont.)						
25. The student knows that a combination of an inductor and a capacitor either in series or in parallel has a "resonant frequency."	H	K1 K3	3 4			
26. The student knows that the resonant frequency of a series or parallel AC circuit is given by $fo = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$	H	K2	3 4			
27. The student knows that a parallel capacitor and inductor exhibit nearly zero current through the parallel system at the resonant frequency.	H	K3	4			
28. The student knows a series capacitor and inductor exhibit maximum current through the series system at the resonant frequency.	H	K3 K8	4			

5. Physics
5.14 Magnetism

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.14.9 Alternating current (AC) circuits (Cont.)						
29. The student knows uses of the resonant AC circuits, such as in tuning radios to a particular frequency.	H	K7 K8	3 4			
30. The student knows ways to construct an operating electrical circuit.	H	K7	2 3 7 8 9			
31. The student is able to identify open and closed circuits.	H	P45	2 3			
32. The student knows evidences of interaction in an operating electrical circuit.	H	K8	4			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15 Atomic Physics						
1. The student knows the location and use of print and nonprint material related to atomic physics (e.g., card catalog: "Physics," "Atoms," "Atomic Energy"; SUBJECT GUIDE TO BOOKS IN PRINT: "Atomic Theory," "Atomic Spectra," "Atomic Energy"; READER'S GUIDE: "Atomic Theory," "Atomic Nuclei," "Atoms--Neutrons"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Atomic Spectra," "Atoms," "Atomic Nuclei"; LEARNING DIRECTORY: "Atomic Spectrum," "Atomic Structure," "Atomic Physics"; area and building audio-visual catalogs: "Atomic Theory," "Atoms," "Atomic Energy").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics

5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.1 Characteristics						
1. The student knows that the atom is defined as the smallest particle of an element.	I U H	K2 K3	3 4		2.2.3	
2. The student knows that the atom can exist alone or in combination with other atoms either of the same kind or different kinds.	I U H	G2 K3	4			
3. The student knows that when two different kinds of atoms combine, a molecule of a compound is formed.	I U H	K2 K8	3 4			
4. The student knows that all atoms of the same material element have the same chemical properties.	I U H	K5	3 4			
5. The student knows that atoms of different elements have different chemical properties.	I U H	K5	4			
6. The student knows that atoms of the same material element have average mass which is characteristic of the particular element.	U H	G2 K3 K5	3 4			
7. The student knows that atoms of the same element may have slightly different masses.	U H	G2 K3 K5	3 4			
8. The student knows that atoms of different elements have different average masses.	U H	G2 K3 K5	3 4			
9. The student knows that atoms cannot be subdivided by ordinary chemical means.	U H	K3	3 4			

5. Physics

5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.1 Characteristics (Cont.)						
10. The student knows that the atomic mass of atoms is expressed in terms of atomic mass units. (1 amu = 1.6660 x 10^{-27} k. This is approximately the mass of a hydrogen atom.)	U H	K2	3 4			
11. The student knows that the mass of atoms of an element is determined with respect to carbon -12 as a standard.	U H	K2 K9	3 4			
12. The student knows the characteristics of atoms as defined or described by various contributors to historic and current atomic studies (e.g., Greeks hypothesized smallest particle at 400 B.C. and named it "atom" for "indivisible").	U H	K3 K4	4			(C)History, science

5. Physics

5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.2 Subatomic particles						
1. The student knows that J. J. Thompson (1865-1940) is credited with the first discovery of the electron.	U H	K1 K4	3 4			
2. The student knows that the electron has a mass of 9.1×10^{-31} kilogram.	U H	K3	3 4			
3. The student knows that the electron has a charge of 1.6×10^{-19} coulomb, and it is negative.	U H	K3	3 4			
4. The student is able to determine, in a physical situation, the electron's ratio of charge to mass.	H	P35	2 3 4			
5. The student knows that electrons exist in states unlike anything we perceive directly, and have some properties which resemble orbits.	I U H	K3 K6	3 4			
6. The student knows that an aggregate of electron states is called an electron cloud because the electron in an atom more closely resembles clouds than orbiting "satellites."	I U H	K2 K3	3 4			
7. The student knows that Ernest Rutherford (1871-1937) is credited as the discoverer of the nucleus of the atom.	U H	K1 K4	3 4			(C)History, science

5. Physics

5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.2 Subatomic particles (Cont.)						
8. The student knows the ways in which Rutherford's discoveries have changed the theories of the make-up of matter.	H	G1 K4 X8	3 4 7			(C)History, science (C)Matter
9. The student knows that the radius of a typical atomic nucleus is 10^{-14} meters.	H	K3	3 4			
10. The student knows that the nucleus is in the order of 10^5 times smaller than the diameter of the smallest atom.	H	K3 K5	3 4			
11. The student knows that the proton is a particle in the nucleus of the atom and has a mass of 1.67×10^{-27} kilograms.	U H	K2 K3 K6	3 4		2.2.3	
12. The student knows that the positive charge of the proton is 1.6×10^{-19} coulomb.	U H	K3	3 4			
13. The student knows that the "atomic number" of an atom is the number of protons in its nucleus.	H	K2	3 4		2.2.3	
14. The student knows that the proton was "discovered" in the period from 1890-1920.	U H	K4	3 4			
15. The student knows that the nucleus of most atoms contains a particle called the neutron.	I U H	K2 K3	3 4			
16. The student knows that James Chadwick is credited with discovering the neutron in 1932.	U H	K1 K4	3 4			(C)History, science

5. Physics

5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.2 Subatomic particles (Cont.)						
17. The student knows that the neutron has a mass of 1.67×10^{-27} kilogram.	U H	K3	3 4			
18. The student knows that the neutron has no electric charge.	U H	K3	3 4			
19. The student knows that the number of neutrons in the nucleus of different atoms of the same element may vary, thus giving rise to isotopes.	U H	K5	3 4			(C)Exploration
20. The student knows the means by which the subatomic particles (electrons, protons, and neutrons) were discovered.	U H	K7	3 4			
21. The student knows that nuclear binding forces hold the protons and neutrons together in the nucleus of the atom. (These forces are neither electromagnetic nor gravitational, but are entirely different kinds of forces.)	H	K7 K8	3 4			
22. The student knows that the nucleus' mass is always less than the sum of the masses of the particles which compose the particular nucleus.	H	K2 K3 K5	4			
23. The student knows that a similar but smaller "mass deficit" also occurs in an ordinary exothermic chemical reaction.	H	K8	1 4			

5. Physics
5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.2 Subatomic particles (Cont.)						
24. The student knows that an exothermic chemical reaction gives off energy (mass) when atoms go together to form a more stable compound.	H	K8	3 4			
25. The student knows that, as a result of exothermic reaction, the mass of the molecule is less than the sum of the masses of the component atoms.	H	K8	1 4			

5. Physics
5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.3 Spectra of atoms						
1. The student knows that many of the theories about atoms have been formulated to explain the results of line spectra observations.	H	K7 K8	3 4			
2. The student knows that a spectrum results when light is spread by a device such as a prism or diffraction grating.	U H	K8	3 4			(C)Color (C)Tools
3. The student knows how a spectrograph produces a line spectrum.	U H	K7 K8	3 4			(C)Tools
4. The student knows that the line spectrum of an atom is a series of slit images from the spectrograph.	H	K2	3 4		2.2.3	
5. The student knows that under proper conditions, an atom can be made to emit sequences of lines in the spectrum ("spectral" series).	H	K6 K8	3 4			
6. The student knows names given to various "spectral" series (e.g., Lyman, Balmer, Paschen, Brackett).	H	K1	3 4			
7. The student knows that the Bohr model of the atom was based on line spectra.	H	K6 K8	3 4			
8. The student knows the postulates of the Bohr atom and the reasons for this model now being obsolete.	H	K2 K8	3 4			

5. Physics
5.15 Atomic physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.15.3 Spectra of atoms (Cont.)						
9. The student knows that all particles have a frequency and wave length (all particles have wave properties).	H	K3	3 4			
10. The student knows that the wave length of a particle with mass (m) and velocity (v) is $\lambda = \frac{h}{mv}$ where h is Planck's constant.	H	G1 K2	3 4			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16 Nuclear physics						
1. The student knows the location and use of print and nonprint materials related to nuclear physics (e.g., card catalog: "Nuclear Physics," "Nuclear Engineering," "Radioactivity"; SUBJECT GUIDE TO BOOKS IN PRINT: "Nuclear Physics," "Radioactivity," "Nuclear Engineering "; READER'S GUIDE: "Nuclear Physics," "Nuclear Reactions," "Nuclear Fuels"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Nuclear Physics," "Nuclear Reactions"; LEARNING DIRECTORY: "Nuclear Physics," "Nuclear Power, Peaceful Use," "Radioactivity"; area and building audiovisual catalogs: "Nuclear Physics," "Radioactivity," "Nuclear Research").	P I U H	K6	3		2.1.1.2 7.3.2.1	(C)Resources (V)Inquiry

5. Physics

5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.1 Characteristics						
1. The student knows the discoverers of natural radioactivity and their discoveries (e.g., Henri Becquerel, Marie Curie).	H	K1 K4	3 4			(C)History, science
2. The student knows that elements which emit radiation upon nuclear disintegration are radioactive.	H	K2 K3	3 4			
3. The student knows that all naturally occurring elements with an atomic number greater than 83 are radioactive (a few below 83 are also radioactive).	H	K3 K5	3 4			
4. The student knows that many man-made elements are radioactive.	H	K3	3 4			

5. Physics

5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.2 Nature of radioactivity						
1. The student knows that all radioactive elements affect light-sensitive photographic film.	H	K8	3 4			
2. The student knows that radioactive elements cause the air surrounding them to be ionized.	H	K6 K8	4			
3. The student knows physiological effects of radioactive elements on living organisms.	U H	K8	4 5			
4. The student knows that the radioactivity of elements decays.	U H	K2 K4	4			
5. The student knows the three types of natural radioactivity (alpha particles, beta particles, and gamma rays).	H	K5	3 4			
6. The student knows the alpha particle is composed of two protons and two neutrons and is a helium nucleus.	H	K3	3 4			
7. The student knows that the beta particle is an electron traveling at speeds approaching the speed of light.	H	K2 K3	3 4		2.2.3	
8. The student knows the gamma ray is a high energy electromagnetic wave.	H	K2 K3	3 4		2.2.3	

5. Physics
5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.2 Nature of radioactivity (Cont.)						
9. The student knows the various characteristics and interactions with matter that the three types of natural radioactivity have (e.g., energy, ionizing abilities, penetrating ability, magnetic effects).	H	K3	4 5 7			
10. The student knows that the Geiger counter is a device to detect ionizing radiation.	U H	K2 K7	3 4		2.2.3	(C)Tools
11. The student is able to use a Geiger counter.	U H	P16	2 3 5 7			
12. The student is able to determine the absorbing properties of radioactivity of various materials using a Geiger counter.	H	P16 P47	2 3 5 7			
13. The student knows that the half-life of a radioactive isotope is the time required for one-half isotope to decay.	H	K2	3 4		2.2.3	
14. The student is able to determine the half-life of radioactive isotopes.	H	P35 P47	2 3 5 7			

5. Physics
5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.3 Nuclear reactions						
1. The student knows that changes in the identity of atoms imply nuclear changes.	U H	K8	4			
2. The student knows that transmutations of atoms involve changes in the atomic number.	H	K2 K4	3 4			
3. The student knows the processes of beta and alpha decay.	H	K4	4			
4. The student knows that the unit of radioactivity is the "curie." (The curie is the quantity of radioactive material which produces 3.7 x 10^{10} disintegrations per second.)	H	K1 K2	3 4			
5. The student knows that the roentgen is the amount of gamma radiation which will produce 1.6I x 10^{12} pairs of ions when it is absorbed by one gram of air.	H	K2 K8	3 4		2.2.3	
6. The student knows that when nuclei split into nuclei of lesser mass, the process is call fission.	H	K2 K8	3 4		2.2.3	
7. The student knows that energy is released when fission occurs with nuclei heavier than an iron nuclei.	H	K6 K8	4			
8. The student is able to interpret fission equations.	H	P41	2 3			
9. The student knows that fission can be induced.	H	K5 K8	4			

5. Physics

5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.3 Nuclear reactions (Cont.)						
10. The student knows that fusion is a nuclear process whereby nuclei of small mass combine to form nuclei of greater mass.	H	K2 K8	3 4		2.2.3	
11. The student knows that fusion processes can occur only at high temperatures (thermonuclear reactions).	H	K2 K6	4			
12. The student knows that controlled fusion processes have been shown to be theoretically possible.	H	G2 K4	4			
13. The student knows that nuclear weapons work on the principles of both nuclear fusion and fission.	H	K7	4 5			

5. Physics
5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.4 Nuclear energy use						
1. The student knows that nuclear reactions operate on the principles of fission such that controlled fission produces new substances and energy.	H	K7 K8	4			
2. The student knows the parts of nuclear reactors and their purposes.	H	K3 K7	3 4			
3. The student knows that "critical mass" refers to a certain minimum amount of fissionable material which is required before a fission reaction can be self-sustaining.	H	K2 K6	3 4		2.2.3	
4. The student knows that if the critical mass is exceeded, and if the emitted neutrons are not absorbed sufficiently, the reaction becomes uncontrollable.	H	K8	4			
5. The student knows that fission reactions are chain reactions.	H	K2 K5	4			
6. The student knows that a chain reaction is one in which the products of the reaction cause additional reactions.	H	K2 K8	4		2.2.3	
7. The student knows that fission reactions can produce very large amounts of thermal energy.	H	K8	4			

5. Physics
5.16 Nuclear physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.16.4 Nuclear energy use (Cont.)						
8. The students knows that a nuclear power plant converts nuclear energy to thermal energy which is then converted to mechanical or electrical energy.	H	K4 K8	4			(C)Tools
9. The student knows the ways in which nuclear energy is used (e.g., propulsion of ships, conversion to electrical energy, medicine).	H	K7	4 5			(C)Tools

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.17 Information						
1. The student knows the historical development of Information Science.	H	K4	1 4 7			(C)Information (C)History, science (V)Cooperation
2. The student knows meaning of major concepts and terminology used in the study of information and information-carrying systems, including: system, entropy, uncertainty, probability, redundancy, channel, capacity, bit.	H	K1 K2	3 4			(C)Information
3. The student knows functions of transmitted information in various systems (e.g., to direct activity, growth, or formations--player piano, DNA molecule; to identify, describe, or translate--communication systems).	H	K7	4 5 7			(C)Information
4. The student knows that the basic unit for measurement of information is the bit (binary digit).	H	K1 K2	3 4		2.2.3	(C)Measurement
5. The student knows that a bit of information presents an either/or choice between equivalent alternatives (e.g., yes something's there or no it isn't).	H	K3 K7	4			
6. The student knows ways in which information bits are coded in various simple systems (e.g., punch tape, electronic communication system, DNA molecule).	H	K7	3 4 7			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.17 Information (Cont.)						
7. The student knows common situations in which information bits may be identified and counted (e.g., locating a given card in card catalog in which each card selected gives information about remaining locations where the desired card might be found; 20 questions game; puzzles; guessing a number).	H	K6	4 5 7			
8. The student knows that a bit carries maximum information when it narrows remaining alternatives by half.	H	K3 K7	4			
9. The student is able to calculate the number of bits of information carried by simple information-carrying systems such as DNA molecules, punched tapes, or numerical representation.	H	P35 P63	3 4 5 7			
10. The student knows that information may be measured as capacities of channels, rates of transmission, or amounts of information contained in a situation.	H	K6 K7	3 4 5			
11. The student knows the characteristics and functions of various information-carrying systems and devices (e.g., information capacities of electronic devices are limited by the ranges of frequencies they can handle; television has higher information transmission rate than does radio, and radio has higher rate than ordinary telephone lines).	H	K3 K7	4 5 7			(C)Communications

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.17 Information (Cont.)						
12. The student knows characteristics and functions of the human information system (see Robert M. W. Travers, MAN'S INFORMATION SYSTEM, Scranton, Pa., Chandler Publishing Co., 1970).	H	K3 K7	1 4 5 7			
13. The student knows symbols, instruments, and formulas used to measure information (e.g., amounts of information, rates of transmission, channel capacities).	H	K2 K7	3 4 5 7			
14. The student knows that information and entropy are different names for a statistical property of systems.	H	K2	3 4		2.2.3	(C)Information (C)Entropy
15. The student knows that information entropy is defined by an equation relating the number of equivalent constituent particles in a system to the number of ways the particles could be arranged to obtain a certain state.	H	K2	3 4		2.2.3	
16. The student knows that the amount of information contained in a situation is expressed as the number of either/or choices between equivalent alternatives (bits) which will exactly describe, reconstruct, or duplicate a state, situation, or system.	H	K2	3 4			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.17 Information (Cont.)						
17. The student knows that the term information is generally used when referring to relatively small systems (earth, organisms, etc.) and entropy generally refers to relatively large ones (e.g., galaxy, universe).	H	K2 K5	3 4			(C)Information (C)Entropy
18. The student knows that information is numerically synonymous with uncertainty (the amount of uncertainty contained in situation = the amount of information which will exactly describe or permit duplication of situation: half empty = half full).	H	K2	3 4			
19. The student knows relationships between amounts of information (uncertainty, entropy) contained in a state, and the probability with which the state occurs (e.g., random, disorganized states have many equivalent alternative arrangements, therefore high probability of occurrence; highly organized states are obtained in relatively few ways, are less probable, are fully described or duplicated with fewer bits of information).	H	K2	3 4 7			
20. The student is able to construct or use a variety of devices to show the relationship of information content to probability in random and ordered states (e.g., card games, drawing sets of balls from bag of mixed-color balls, picking seeds out of sorted and unsorted piles).	H	P76	2 3 7			(C)Information

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.17 Information (Cont.)						
20. The student knows formulas and procedures used to measure information in human communications.	H	K2 K7	3 4 5 7			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.18 Forefronts of physics						
1. The student knows problems and questions which have given rise to various current inquiries in physics and its related fields (e.g., conflicting data, theories, or hypotheses; mathematical extrapolation which suggests new phenomena to be explored).	H	K4 K8	4 5 7			
2. The student knows other disciplines and subdisciplines with which physics shares subject matter, data, procedures, or tools in current inquiries (e.g., mathematics, astronomy, chemistry; systems, information, engineering sciences).	H	K5 K6	4 6			(C) Specialization (V) Cooperation
3. The student knows reasons why inter-disciplinary cooperation is necessary in the validation of current physics research (e.g., variety and complexity of relevant data, interrelationships between relevant concepts from various disciplines).	H	K4 K7	1 4 5 7			(C) Cooperation (C) Specialization
4. The student knows that research is being conducted on the structure of liquids (e.g., identifying liquid structure, developing theory for the behavior of liquids).	H	K4 K6	4 7			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.18 Forefronts of physics (Cont.)						
5. The student knows that physicists, mathematicians, and astronomers are currently investigating black holes in space (stars which have collapsed so catastrophically that they literally leave our universe, forming objects from which nothing within a certain distance can escape and within which time and distance exchange many properties).	H	K4 K6	1 4 7			
6. The student knows that a subject of current research is tachyons (particles which exist beyond the speed of light).	H	K4	1 4 7			
7. The student knows unanswered questions currently being researched by nuclear physicists and scientists in related fields, including: (1) Can nuclear fusion be controlled? How? (2) What laws govern nuclear forces? (3) What might nuclear particles be broken up to form, if they may be broken?	H	K4 K6	1 4 5 7			
8. The student knows questions and problems involved in the study of magnetic monopoles, including: (1) Do they exist? (2) Equations of electromagnetic interaction are symmetrical between electric fields and magnetic fields, but there is nothing magnetic comparable to a single point of charge which can generate the electric field.	H	K6 K7	1 4 5 7			

5. Physics

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
5.18 Forefronts of physics (Cont.)						
9. The student knows questions involved in the study of antimatter, including: are there galaxies, solar systems, planets, or gas clouds in space composed of antimatter?	H	K6 K7	1 4 5 7			
10. The student knows "constants" of nature whose constancy is currently being questioned (e.g., charge on the electron, mass of the electron, gravitational constant, Planck's constant).	H	K4 K5	1 4 5 7			

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.1 History of astronomy						
1. The student knows the location and use of print and nonprint materials related to history of astronomy (e.g., card catalog: "Astronomy"; SUBJECT GUIDE TO BOOKS IN PRINT: "Astronomy-History"; READER'S GUIDE: "Astronomy-History"; APPLIED SCIENCE AND TECHNOLOGY: "Astronomy"; LEARNING DIRECTORY: "Astronomy"; area and building audiovisual catalogs: "Astronomy").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that astronomy is the study of solid and gaseous bodies in space and their interrelationships.	I U H	K2	3 4		2.2.3	
3. The student knows the contributions of famous and current astronomers.	P I U H	K1 K4	4			(C)History of science (V)Respect for others
4. The student knows that the study of astronomy is continuing and changing as more sophisticated instruments and techniques are developed.	P I U H	G2 K4 K8	4			(C)History of science
5. The student knows that people throughout history have tried to explain what they see in the sky, often through myths, legends, and stories.	P I	G2 K7	4			(C)History of science

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.1 History of astronomy (Cont.)						
6. The student knows astronomical discoveries and concepts generated in various ancient civilizations (e.g., Chinese, Egyptian, Babylonian, Greek) and factors which affected their development (e.g., technology, cultural beliefs, economics).	I U H	K3 K8 K10	4			(C)History of science (V)Respect for others (C)Culture (C)Theory
7. The student knows the basic elements of Ptolemaic model of the universe.	I U H	K3	3 4			
8. The student knows basic elements of the Copernican model of the universe.	I U H	K3	3 4			
9. The student knows ways in which discoveries, principles, laws, and theories developed in other sciences have affected the science of astronomy (e.g., contributions of mathematicians, physicists).	I U H	K8	3 4			(C)History of science (V)Interdependence (V)Cooperation (V)Diversity (V)Respect for others

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2 Stellar system						
1. The student knows the location and use of print and nonprint materials related to stellar system (e.g., card catalog: "Astronomy," "Stars"; SUBJECT GUIDE TO BOOKS IN PRINT: "Stars," "Constellations," "Galaxies"; READER'S GUIDE: "Stars," "Stars-Evolution," "Stars-Age," "Galaxies"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Stars," "Nebulae," "Stars-Spectra"; LEARNING DIRECTORY: "Stellar Constellations," "Star, Evolution," "Star, Galaxy"; area and building audiovisual catalogs: "Stars," "Astronomy").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.1 Theories of origin						
1. The student knows that people have held many different beliefs throughout history about how and when the universe began.	P I U H	G2 K4	4			(C)Universe (C)Perspective
2. The student knows similarities and differences between scientific theory and cultural or religious belief.	P I U H	K5	1 4			(C)Theory (C)Belief (V)Discrimination
3. The student knows that there are various scientific theories about the origins of the universe.	P I U H	G2 K5	4			(C)Theory
4. The student knows names and basic ideas associated with various current theories of the origin of the universe (e.g., "Big Bang," "Pulsating," "Steady State").	P I U	K1 K5	3 4		6.1.3.1	(C)Universe
5. The student knows factors which affected the formation of various historic theories of the universe's origin (e.g., instruments and procedures available for research, geographic and cultural contexts.	P I U H	K6 K8	4			(C)Theory (C)History of science (C)Perspective
6. The student knows hypotheses basic to selected historic and current theories of the universe's origin.	U H	K5 K9	4			(C)History of science (C)Universe
7. The student knows data, principles, and definitions basic to current theories concerning the origin of the universe.	U H	K6 K9	3 4			(C)Universe

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.2 Galaxies						
1. The student knows major characteristics of galaxies (e.g., large in size--consist of many stars each of which is a large distance away from its neighbor, far away from us, large in number, moving).	P I U	K3	4			
2. The student knows that there are four main kinds of galaxies based upon their observed shape: barred, irregular, spiral, and elliptical.	U H	K2 K8	3 4			
3. The student knows that the earth is located in the Milky Way galaxy.	P I	K6	4			
4. The student knows that the solar system is located in the Milky Way galaxy.	P I	K6	4			
5. The student knows that the Milky Way is considered to be a spiral galaxy.	U H	K2 K3	3 4			
6. The student knows the approximate location of the solar system in the Milky Way galaxy.	U H	K6	4			
7. The student knows that galactic systems are held together by gravity.	P I U	G1 K8	4		5.4.4	

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.2 Galaxies (Cont.)						
8. The student knows that astronomers have recently detected the existence of "black holes in space," a phenomenon first hypothesized by mathematicians and physicists.	U H	K4 K6	4		5.18	(C)History of Science (C)Prediction
9. The student knows that "black holes in space" apparently have properties which contradict known physical laws and principles (e.g., time and distance exchange characteristics).	U H	K3	4		5.18	

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.3 Constellations						
1. The student knows that a constellation is a group of stars that appear, from man's viewing position, to form a pattern in the sky.	P I U	K2	3 4		2.2.3	(C)Universe (C)Perspective (C)Perception
2. The student knows names and relative positions of selected constellations.	P I U H	K1 K6	3 4			
3. The student knows the location of selected constellations with respect to changes in latitude and seasonal time.	I U H	K6 K8	4			
4. The student is able to use a star chart to find constellations.	P I U H	P41 P44	2 3		2.1.4.1	
5. The student knows that the apparent hourly change in position and rate of motion of constellations is due to the motions of the earth.	P I U	K6 K8	4			(C)Universe (C)Perspective (C)Perception
6. The student knows that some constellations were named for mythological figures.	P I U	K1	3 4		2.2.3	(C)Mythology
7. The student knows ways in which humans have historically used or interpreted the appearance of constellations (e.g., navigation, attempts to predict the future, mythology).	P I U	K4 K6 K7	4			(C)Culture (C)Mythology (C)Tools

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.4 Nebulae						
1. The student knows the main characteristics of a nebula (e.g., usually irregular in shape, consists of dust or gas, large in size, and far away).	U H	K3	4			
2. The student knows the different types of nebulae (e.g., spiral, planetary).	U H	K5	4			

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.5 Stars						
1. The student knows that the earth's North-South axis points approximately toward the North Star (Polaris).	P I	G2 K6	4		6.1.3.3	
2. The student knows that in the past the earth's axis pointed to different stars (e.g., in 4th Century, B. C. Alpha Draconis was the polestar).	I U	K4 K6	4		6.1.3.3	(C)History of science
3. The student knows that polestar is defined as the star at which the earth's axis is pointed.	P I	K2	3			
4. The student is able to locate the North Star (Polaris) using the pointer stars in the Big Dipper as reference points.	P I	P11 P42	2			
5. The student knows significant stars (e.g., Polaris and Vega for navigation, Sirius for being the brightest star, and Alpha Centauri and Proxima Centauri for being the closest stars).	I	K3	4			
6. The student knows that stars appear to twinkle because the light coming from them is refracted by our atmosphere.	U H	K3 K8	4		5.11.5	
7. The student knows that stars are composed mainly of hydrogen gas (50-75%) and helium gas (20-45%) and that the combination of hydrogen and helium accounts for 98% of the mass of most stars.	U H	K3	4			

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.5 Stars (Cont.)						
8. The student knows that the Hertzsprung-Russell (H-R) diagram is a graph that shows the relationship between the luminosities and temperatures of stars.	H	K2	3		2.2.3	
9. The student knows the names of currently defined categories of stars (e.g., quasar, pulsars, binaries, neutron stars--white dwarfs, red giants, nova, and supernova).	H	K1	3		2.2.3	
10. The student knows characteristics by which stars are categorized as quasars, pulsars, etc.	H	K3 K5	4			
11. The student knows relationships between a star's size, mass, luminosity, temperature, color, and life span.	U H	K8	4			
12. The student knows that the apparent brightness of a star is dependent upon its absolute brightness and its distance away from us (directly proportional to the absolute brightness and inversely proportional to the square of the distance).	H	G1 K8	4		2.1.1.1 5.11	(C)Perception
13. The student knows that the sun is of average size, mass, absolute brightness, and temperature as compared to other stars.	U H	K5	4			

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.5 Stars (Cont.)						
14. The student knows the importance of the North Star (Polaris) to celestial navigation.	U H	K3 K7	4			
15. The student knows that the North Star (Polaris) doesn't appear to move relative to the earth's motion.	U H	K6	4		2.1.1.1	(C)Perception
16. The student knows that the North Star is the last star in the handle of the Little Dipper.	P	K6	4		6.1.2.3	
17. The student knows that the North Star can be located by reference to the Big Dipper.	P	K6	4			
18. The student is able to locate the North Star.	P	P11 P41	2			
19. The student knows that the North Star (Polaris) can only be seen from the northern hemisphere of the earth's surface.	P I	K3 K6	4			
20. The student knows that differing stellar spectra are due to differences in temperature rather than differences in chemical composition.	U H	K5 K8	4		4.8 5.11.6	

6. Earth and space sciences
6.1 Astronomy
6.1.2 Stellar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.2.5 Stars (Cont.)						
21. The student knows that stellar average temperatures range from about 1,000° C to 30,000° C.	U H	X3	4			
22. The student knows that stellar energy arises from nuclear reactions.	H	K8	4			

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3 Solar system						
1. The student knows the location and use of print and nonprint materials related to solar system (e.g., card catalog: "Solar System," "Sun," "Earth," "Planets"; SUBJECT GUIDE TO BOOKS IN PRINT: "Solar System," "Comets," "Meteors," "Satellites"; READER'S GUIDE: "Solar System," "Planets," "Earth," "Satellites," "Moon"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Solar System," "Meteors," "Planets"; LEARNING DIRECTORY: "Solar System, Sun," "Solar System, Origin, Theory," "Satellite, Artificial"; area and building audiovisual catalogs: "Solar System," "Earth," "Moon," "Sun").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.1 Theories of origin						
1. The student knows theories concerning the origin of the solar system (e.g., "Big Bang," "Pulsating," "Steady State," "Planetesimal," "Exploding Star," Nebular, Tidal, Collision and Gravitational).	U H	G1 K8	4		6.1.2.1	(C)Universe
2. The student knows data, principles and definitions basic to current theories concerning the origin of the solar system.	U H	K2 K3 K9	4		6.1.2.1	(C)Universe

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun						
1. The student knows that the sun is in constant motion.	P	K3	4			
2. The student knows ways of gaining information about the sun (e.g., observation, looking at shadows).	P I	K7	2 5		2.1.1	
3. The student is able to design and construct instruments for determining the position of the sun.	P I U	P67	2 8		2.1.6.4	
4. The student knows that an "a.m." shadow will have a corresponding "p.m." shadow of the same length.	I	G2 K2	3		5.11.2	
5. The student knows ways of illustrating the sun's movement.	P	K7	3			
6. The student knows ways of casting shadows (e.g., clear light bulb, slide projector, sunlight).	P	K7	3		5.11.2	
7. The student knows the relationship between the position of a shadow and the position of the sun.	P I	K6 K8	4		5.11.2	
8. The student knows that astronomers examine the sun from photographs or reflected images.	P I U	K2	3			(C)Safety
9. The student knows the ways in which the sun's apparent path changes throughout the year.	P I	K5 K8	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun (Cont.)						
10. The student knows that the sun appears to cross the sky from east to west and is at its highest point (zenith) at approximately noon each day.	P I	K4 K6	4			
11. The student knows the measurement of solar time represents the relationship between movement of the sun and earth.	P I	K2 K8	3 4		5.1.4	(C)Measurement (C)Time
12. The student knows that the sun is approximately, rather than exactly overhead due to the inclination of the earth's axis to the plane of the ecliptic.	H	K6 K8	4			
13. The student knows causes of differences in the amount of sunlight reaching specific latitudes of earth at different times of the year.	P I	K8	4		5.11.1	
14. The student knows the relative positions of the earth, moon, and sun during a solar eclipse.	P I	K6 K8	4			
15. The student knows the ways in which the movements and tilt of the earth (in relationship to the sun) affect the seasons; length of day, night, and year; length and directions of sunrise and sunset; insolation; temperatures, and climate.	P I	K8	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun (Cont.)						
16. The student knows that the sun can be used to determine direction and the time of day.	P I	K7	4			(C) Time (C) Tools
17. The student knows that the sun, sun spots, and solar eclipses should be viewed only as a reflected or projected image (permanent damage to the eyes can result from viewing the sun directly).	P I	K7	4 5			(C) Safety
18. The student knows proper safety precautions that should be taken when viewing the sun, sun spots, and solar eclipses.	P I	K7	4 5			(C) Safety
19. The student knows the following terms and their meanings in relationship to the solar system: sun, planets, moon, satellites, comets, shooting stars, meteors, meterorites, asteroids.	P I U	K1 K2	3		2.2.2	
20. The student knows why the earth's poles change position in relationship to the sun.	U H	K8	4			
21. The student knows that the equinox occurs when the sun is directly above the earth's equator and days and nights are each 12 hours long the world over.	I U	K2 K8	4			
22. The student knows that due to the 23½° tilt of the earth at no time does the sun appear more than 23½° above the horizon at the poles.	U H	K2 K8	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun (Cont.)						
23. The student knows that the earth's main source of heat and light is the sun.	P I	G2 K2	4		5.9.1 5.11.1	
24. The student knows the three designated layers of the sun: photosphere (visible gaseous surface of the sun), chromosphere (reddish layer above photosphere), and corona (outermost layer).	U H	K1 K2	3			
25. The student knows that a solstice occurs when the sun is closest to an earth's pole.	U H	K8	4			
26. The student knows that the vast amount of energy in the universe comes from the sun and other stars as a result of nuclear reactions of these stars. (These nuclear reactions are thermonuclear fusion--basically the change of hydrogen to helium.)	U H	K3 K8	4		5.16.3	(C)Universe (C)Energy
27. The student knows that the sun spots close to the sun's equator complete their rotation more quickly than those closer to the poles (the rotational velocity of the sun's surface is greater at the sun's equator and the sun, being gaseous, does not rotate as a solid).	U H	K5	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun (Cont.)						
28. The student knows that flares are associated with sunspots.	U H	K10	4			
29. The student knows that flares are emissions of hydrogen gas which send out X-rays, charged electrons, and protons which cause magnetic storms.	U H	K2 K8	3 4		2.2.3 5.14.1	
30. The student knows that magnetic storms cause auroras and disrupt the ionosphere which disrupts radio communication.	U H	K4 K8	4		5.14.1	(C)Communications
31. The student knows that the sun has an average size, mass, and temperature as compared with other stars.	U H	K5	4			
32. The student knows that the term "solar system" is derived from the term "sun" system and is defined as a system of satellites revolving around the sun.	U H	K1 K2	3		2.2.3	
33. The student knows that the sun, according to present theory on the evolution of stars, was formed by the contraction of particles under the influence of gravity, causing it to heat up until a thermonuclear reaction started.	U H	G1 K8	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun (Cont.)						
34. The student knows nuclear reactions that take place within the sun's interior change mass into energy ($E=mc^2$).	H	K8	4		5.16.3	(C)Energy
35. The student knows that the comparative amount of energy from the sun that each planet receives is inversely proportional to the square of the distance the planet is from the sun and is proportional to the size of the planet.	H	K3 K10	4			
36. The student knows that the fusion of hydrogen to helium in a hydrogen bomb is a thermonuclear reaction comparable to the nuclear reaction in the sun and other stars.	H	K2 K8	4		5.9.7 5.16.3	
37. The student knows that sunspots (darker areas on the sun) are darker because they are cooler than the rest of the sun's visible photosphere.	I U H	K5 K8	4			
38. The student knows that sunspots are believed to be cyclonic-like storms on the sun in which gases rise to the surface of the photosphere, expand and cool and therefore appear darker.	U H	K2 K8	4			
39. The student knows that scientists are investigating the theory that earth weather conditions are systematically related to the observed cyclic behavior of sunspots.	U H	K8	4			(C)Weather

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.2 The sun (Cont.)						
40. The student knows that the sun, according to present theory on the evolution of stars, will flare up or explode into a nova, eventually collapse into a white dwarf, and its fusion reactions will stop.	U H	G1 K4	3			
41. The student knows methods of capturing the sun's energy for human use (e.g., heat and power--parabolic mirrors, glass (greenhouse effect), solar cells (silicon-dioxide and boron wafers).	H	K7	4			(C)Survival (C)Resources (C)Energy

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (See also 6.3 Geology)						
1. The student knows that the earth is in constant motion.	P I	G1 K3	4		5.3	(C)Dynamics
2. The student knows that the earth revolves and rotates simultaneously.	P I	G1 K3 K4	4			(C)Dynamics
3. The student is able to identify phenomena resulting from the motions of the earth (e.g., day and night, seasons).	P I	P42 P44	2			(C)Dynamics
4. The student knows that the earth rotates from west to east once in 24 hours.	P I	K6	4			
5. The student knows that the earth revolves around the sun once each year.	P I	K6	4			
6. The student knows the reasons why daylight lasts longer in summer than in winter at nonequatorial latitudes.	P I U	K8 K6	4			
7. The student knows meanings of terms used to specify spatial and dynamic relationships between earth and the sun.	P I U	K2	1 3 4		2.2.2 5.3 5.7	(C)Measurement (C)Frame of reference (V)Communication (V)Clarity (V)Accuracy

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (Cont.)						
8. The student knows meanings of terms used to locate or represent position on the earth with reference to the sun (e.g., latitude, longitude, northern hemisphere, southern hemisphere).	I U	K2	1 3 4		2.2.3 5.7	(C)Measurement (C)Frame of reference (V)Communication (V)Clarity (V)Accuracy
9. The student knows the names of the seasons that occur in a particular geographic area due to the tilt of the earth and its revolution around the sun.	P	K1	1 3 4		2.2.3	(C)Seasonal change (V)Communication (V)Clarity (V)Accuracy
10. The student knows meanings of terms used to specify seasonal phenomena resulting from the earth's tilt and its revolution around the sun (e.g., vernal equinox, autumnal equinox, summer solstice, winter solstice).	I U H	K2	1 3 4		2.2.3	(C)Seasonal changes (V)Communication (V)Clarity (V)Accuracy
11. The student knows significant data related to earth's spatial relationship to the sun (e.g., distance, angle of inclination).	I U	K2 K3	3 4			
12. The student knows that the globe is a model of the earth.	P	K2	3 4		2.2.4	
13. The student is able to manipulate models to illustrate spatial and dynamic relationships between earth and sun.	P I U H	P 35	1 2 3		2.2.4	(V)Objectivity (V)Insight

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (Cont.)						
14. The student is able to collect and organize data about daily or seasonal changes in sun's apparent position and movement in the sky.	P I U H	P32	1 2 3		2.1.3	(C)Data representation (C)Research (V)Inquiry (V)Organization (V)Clarity
15. The student is able to interpret observational data about daily or seasonal changes in sun's apparent position and motion, relating the data to scientific knowledge of earth's position and motions.	P I U H	P44	1 2 3		2.1.4 5.3	(C)Data interpretation (V)Inquiry (V)Perspective
16. The student is able to collect and interpret observational data about seasonal changes of climate, relating the data to scientific knowledge of earth's position and motions.	I U H	P44	1 2 3		2.1.4 5.3	(C)Data interpretation (V)Inquiry (V)Perspective
17. The student knows earth's position (frame of reference) within the universe in relationship to planets--earth, stars--the sun, and galaxies--the Milky Way).	I U H	K6	1 3 4		5.3.1 5.7.1	(V)Perspective

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (Cont.)						
18. The student knows that Keppler's first law states that the orbits of the planets around the sun are ellipses with the sun occupying one focus of the ellipse.	U H	G1 K4 K6	3 4			(C)History of science (C)Scientific laws
19. The student knows that Keppler's second law states that the planet, in orbit around the sun, when closer to the sun moves faster and when further from the sun moves more slowly.	U H	G1 K4 K6	3 4			(C)History of science (C)Scientific laws
20. The student knows that the earth is not perfectly round; it is an oblate spheroid, flattened somewhat at the poles.	U	K3	4			
21. The student knows significant data related to earth's size and shape (e.g., the earth is about 8,000 miles in diameter, about 25,000 miles in circumference with a bulging of about 27 miles at the equator, a smaller bulge in the southern hemisphere, and many small "bumps" called geodes).	I U H	K3	3 4			
22. The student knows the historical evidence that revealed the shape of the earth (e.g., ships appearing to sink as they travel toward the horizon, the shape of the earth's shadow during a lunar eclipse).	P I U H	K3 K4	3 4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (Cont.)						
23. The student knows that the earth is at a distance from the sun where the temperature range (0° - 100° C.) is such that water is found naturally in its three states (solid, liquid, and gas).	U H	K6 K8	4		4.2 5.8.2	
24. The student knows that the Van Allen Belts are two rings of radiation around the earth which are shaped by the earth's magnetic field (these belts trap particles from the sun).	U H	K1 K6	3 4		5.14.4	
25. The student knows that the magnetic poles of earth do not coincide with the geographic poles.	I U	K6 K10	3 4			
26. The student is able to distinguish between magnetic and geographic poles.	I U H	P45	2 3			
27. The student knows that earth's magnetic poles change positions.	I U H	G2 K6	4		6.3.2 6.4.8.1	
28. The student knows that magnetic north in some parts of the United States is considerably out of line with true north.	I U	K3	3 4			
29. The student knows that compasses point to magnetic north rather than to true north.	P I	K2 K6	1 3 4			(V)Resourcefulness (V)Utility

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (Cont.)						
30. The student knows measurement turns, units and instruments used to locate or represent positions on the earth (e.g., latitudinal lines, meridians; degree, minute, second; sextant, compass).	P I U H	K2	1 3 4		2.2.1 7.2	(C)Measurement (C)Frame of reference (V)Resourcefulness (V)Utility
31. The student knows mathematical and physical principles upon which latitude-longitude measurements are based.	P I U H	G1 K2	1 3 4			(C)Measurement (C)Frame of reference (V)Resourcefulness (V)Utility
32. The student knows how latitudes are found.	U H	K2 K7	1 3 4		2.2.1	
33. The student knows instruments used to measure and mark locations on the earth (e.g., surveyor's tools, bench marks).	U H	K2	1 3 4		2.2.1	(C)Measurement (C)Frame of reference (V)Resourcefulness (V)Utility
34. The student knows that degrees of latitude have a constant distance between them, but degrees of longitude do not (e.g., widest at equator, converging at poles).	I U H	K2 K5	3 4		2.2.1	
35. The student is able to accurately decode conventional terms and symbols representing a particular location (e.g., find the place on a map or globe).	I U H	P41	1 2 3		7.2	(C)Measurement (V)Accuracy (V)Communication (V)Resourcefulness (V)Utility

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.1 The earth (Cont.)						
36. The student is able to represent a location in terms of conventional latitude-longitude measurements	I U H	P66	1 2 3		2.2.1 2.2.3	(C)Measurement (V)Accuracy (V)Communication (V)Resourcefulness (V)Utility

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.2 Other planets						
1. The student knows the name and approximate location of those planets visible to the naked eye.	P I	K1 K6	3 4			
2. The student knows ways in which the probable atmospheric composition of planets is determined (e.g., spectroscope).	U H	K2 K7	3 4		5.15.3	(C)Research (C)Tools
3. The student knows that the existence of the planet Neptune was predicted before it was discovered because of orbital changes of Uranus (gravitational effects).	I U H	K4	1 4	1		(C)History of science (V)Prediction
4. The student knows that Pluto's existence was predicted because of Neptune's orbit.	I U H	K4	1 4	1		(C)History of science (V)Prediction
5. The student knows ways in which the existence of planets can be predicted before they are discovered (e.g., gravitational effect--orbital changes).	I U H	K2 K7	4			(C)Research (C)Data interpretation
6. The student knows some general characteristics of each of the nine planets (e.g., length of days and years, chemical composition of the atmospheres, number of moons, sizes, distances from the sun).	P I U H	K3	4			
7. The student knows how past and future positions of planets or moons are found.	I U H	K2 K7	4			(C)Research (C)Data interpretation

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.3 The planets

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.3.2 Other planets (Cont.)						
8. The student knows that the planets and moons (satellites) reflect light from the sun.	P I	K3	4		5.11.4	

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.4 Satellites

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.4.1 Natural						
1. The student knows that the earth has one major natural satellite, the moon.	P	K3	4			
2. The student knows that the moon rotates once as it revolves around the earth once, thus the same side of the moon always faces the earth.	P I	K4 K8	4			
3. The student knows that the moon doesn't have an atmosphere because it does not have enough gravitational pull to hold an atmosphere.	I U	K3 K8	4			
4. The student knows that without an atmosphere there is no weather, sound, or decomposition (oxidation).	I U	K3 K8	4			
5. The student knows that the main topographical features on the moon are craters, mares, faults, mountain ranges, rilles, rays, crater walls.	I U	K3 K6	4			
6. The student knows comparisons between the earth and its moon (e.g., diameter, volume, mass, gravitational pull).	I U	K2 K10	3 4			
7. The student knows how data being collected from exploration of the moon are being used to compare it with earth (age, structure, crystal composition and changes, and theories as to its origin).	P I U H	K2 K7	1 3 4	1		(C)Data interpretation (V)Respect for others (V)Inquiry

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.4 Satellites

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.4.1 Natural (Cont.)						
8. The student knows that there are definite patterns to the motion of the moon in relation to the sun or the planets.	P I	K3 K4	1 4			(V)Unity (V)Organization (V)Nature
9. The student knows that there is an order in the phases of the moon.	P I	K4	1 4			(V)Unity (V)Organization (V)Nature
10. The student knows that accurate predictions can be made as to location and phase of the moon.	P I	K2 K4 K6	1 3 4	1		(V)Prediction (V)Organization (V)Inquiry
11. The student knows names of phases of the moon, and the appearance of the moon in each phase (e.g., new, crescent, quarter, half, full).	I	K1 K3	3 4			
12. The student knows that phases of the moon are changes in what we can see, rather than in the moon itself, and are caused by the earth's shadow (changing relative positions of earth, moon, and sun).	P I U	K2 K6	3 4		5.11.2	
13. The student knows ways of illustrating relative positions of the moon, earth, and sun (e.g., visual media, models).	P I U	K2	3 4		2.2.4	
14. The student knows the relative positions of the earth, moon, and sun during a lunar eclipse.	P I U	K6	4			
15. The student is able to illustrate moon phases and eclipses through use of models.	P I U	P35	2 3			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.4 Satellites

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.4.1 Natural (Cont.)						
16. The student is able to illustrate the moon's motion through use of model.	P I U	P35	2 3		2.2.4	
17. The student knows that the moon exerts gravitational pull upon the earth, as well as vice versa.	I U	G1 K8	4		5.14	
18. The student knows phenomena which illustrate the moon's gravitational interaction with the earth (e.g., moon's orbit, earth's tides).	I U	K3	4			
19. The student knows that other planets in the solar system have moons.	P I	K3	4			
20. The student knows that some planets have no moons while others have one or more.	P I	K3	4			
21. The student knows that each moon travels in its own orbit around a planet.	P I	G1 K3 K6	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.4 Satellites

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.4.2 Artificial						
1. The student knows purposes served by man-made satellites (communication, weather forecasting, reconnaissance, outer space exploration, gathering data on the atmosphere, measuring gravitational pull, and determining the size and shape of the earth, etc.).	I U	K7	4			
2. The student knows scientific principles, laws, and theories upon which satellite research and development are based.	H	G1 K7	4			
3. The student knows contributions of various scientists, corporations, institutions, governments, etc., to the development of man-made satellites.	I U H	K3 K4	1 4	1		(C)Research (C)Technology (V)Respect for others
4. The student knows major problems which faced science, industry, and government during research, development, and production of various satellites.	I U H	K3	1 4	1		(C)Technology (V)Problem solving
5. The student knows significant technological advances which permit the production and orbiting of man-made satellites.	I U H	K3 K7	1 4	1		(C)Technology (V)Utility (V)Respect for others (V)Progress
6. The student knows structural characteristics common to man-made satellites.	I U H	K3	4			

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system
6.1.3.4 Satellites

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.4.2 Artificial (Cont.)						
7. The student knows specific features of selected satellites, and the functions they were designed to perform.	I U H	K3 K7	4			
8. The student knows current developments in technology of manned and unmanned satellites.	I U H	K3 K4	1 4	1		(C)Technology (V)Progress (V)Respect for others

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.5 Comets						
1. The student knows that a comet's orbit is much more elliptical than a planet's orbit.	P I U	K3	4			
2. The student knows that solar radiation ("solar wind") forces the comet tail of fine dust and gases in the direction away from the sun.	P I U	K7	4			
3. The student knows that a comet's path can be mapped and predicted.	P I U	K4 K6	4			
4. The student knows that paths of comets are generally predictable (e.g., Halley's).	P I U	G2 K4	4			
5. The student knows that comets orbit the sun.	P I U	K6	4			
6. The student knows theories of the origin of comets (e.g., formed beyond Neptune; remnants too weak gravitationally to condense into solid spheres, but strong enough to stay in system).	I U H	K2 K3	4			(C)Theory

6. Earth and space sciences
6.1 Astronomy
6.1.3 Solar system

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.3.6 Meteoroids and asteroids						
1. The student knows that comets leave a trail of meteoroids or comet fragments.	I U H	K3	4			
2. The student knows that meteors are meteoroids entering earth's atmosphere and burning.	I U H	K1 K2	4			
3. The student knows that meteorites are meteoroids reaching earth's surface without being burned in the atmosphere.	I U H	K1 K2	3 4			
4. The student knows the composition of the three kinds of meteorites. (Metal--basically of iron and nickel composition; Stone--basically iron, magnesium, silicate minerals; Stone-Metal--iron, nickel, and silicates).	U H	K5	4			
5. The student knows theories of origin of meteoroids (e.g., left over from comet's or asteroid's tail; remnants left in space; fragments of planet that broke up).	I U H	G1 K8	4			(C)Theory (C)History of science
6. The student knows that asteroids are thought to be either materials that didn't have enough gravitational pull to form a planet or the remains of a planet that broke up after formation.	I U H	G2 K3	4			

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.4 Tools of astronomy						
1. The student knows the location and use of print and nonprint materials related to tools of astronomy (e.g., card catalog: "Astronomical Instruments," "Astronomical Photography," "Telescope"; SUBJECT GUIDE TO BOOKS IN PRINT: "Astronomical Instruments," "Astronomical Photography"; READER'S GUIDE: "Planetariums," "Astronomical Instruments," "Astronomical Photography"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Astronomical Measurements," "Astronomical Instruments"; LEARNING DIRECTORY: "Astronomical Measurements," "Astronomical Instruments"; area and building audiovisual catalogs: "Astronomical Instruments").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.1 Astronomy
6.1.4 Tools of astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.4.1 Astronomical measurements						
1. The student knows that astronomers measure the distance between the line of the horizon and an object in the sky in angular degrees.	I U H	K2	3 4		2.2.1.4	(C)Measurement
2. The student knows that our conventional directions used in the earth frame of reference (up, down, north, south, east, west) do not apply in space, but that direction is described in terms of distance and angle of points in space.	I U H	K2	3 4			
3. The student knows the meaning of the terms right ascension and declination as related to the describing of the location of objects in the sky.	U H	K1 K2	3 4		2.2.3	
4. The student knows the meaning of the following units of measurement: astronomical unit, light year and parsec.	U H	K2	3 4			
5. The student knows that parallax is defined as an apparent shift in the background when looking at an object from different positions.	U H	K1 K2	3 4			
6. The student knows that parallax can be used to find distance in the solar system and to nearby stars.	U H	K2 K7	3 4			

6. Earth and space sciences
6.1 Astronomy
6.1.4 Tools of astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.4.1 Astronomical measurements (Cont.)						
7. The student knows that light intensity varies inversely with the distance squared.	H	G1 K2	3 4		5.11	
8. The student knows that the relationship of light intensity to distance is used to find distances in the universe.	H	K2	3 4			(C)Measurement
9. The student knows that apparent size is relative to distance and other objects (e.g., the sun, a medium-size star, looks larger because it is closer).	I U H	G1 K6	3 4			
10. The student knows that positions on the surface of the earth, moon, etc., are measured in degrees latitude in the north-south direction and in degrees longitude in the east-west direction.	I U H	K2	3 4		2.2.1.4	(C)Measurement
11. The student knows that triangulation and trigonometry are used to find distances and positions on the earth and in the solar system.	H	K2	3 4		2.2.1.4	(C)Measurement
12. The student is able to determine position or distance by triangulation.	H	P35	1 2 3		2.2.1.4 2.1.3.5	(C)Measurement (V)Resourcefulness (V)Utility (V)Accuracy
13. The student knows that it is possible to determine the "date" of origin of stars or stellar systems through measurements of the radiation which we receive from them.	H	K2	3		5.16.2	

6. Earth and space sciences
6.1 Astronomy
6.1.4 Tools of astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.4.2 Astronomical instruments						
1. The student knows that there is a difference between a reflecting and refracting telescope in terms of their focusing system.	I U H	K5	3 4		4.11	(C)Tools
2. The student knows uses of radiotelescopes.	I U H	K2 K7	3 4			(C)Tools
3. The student knows that the spectroscope is used to find the chemical composition of those objects in space which give off their own light.	I U H	K2 K7	3 4			(C)Tools
4. The student is able to analyze light given off by objects through the use of a spectroscope and relate the light to the chemical composition of the object.	H	P43	1 2 3			(V)Mastery (V)Inquiry (V)Resourcefulness
5. The student knows ways in which computers are used in the gathering, processing, storage, and retrieval of astronomic data.	U H	K2 K7	1 3 4	1		(C)Tools (C)Research (V)Respect for others (V)Utility (V)Organization
6. The student knows current and projected advances in the technology of astronomic research.	U H	K2 K4	1 3 4	1		(C)Technology (C)Research (V) Progress
7. The student knows instruments used to measure positions by triangulation (e.g., sextant, chronometer)	U H	K2 K7	3 4			(C)Measurement (C)Tools

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.5 Dynamics (forces, motion, and time) (See also 5.4 Dynamics)						
1. The student knows the location and use of print and nonprint materials related to dynamics (e.g., card catalog: "Space Sciences," "Space Environment"; SUBJECT GUIDE TO BOOKS IN PRINT: "Space Environment," "Solar Energy," "Solar Radiation," "Solar Wind"; READER'S GUIDE: "Solar Energy," "Solar Wind," "Solar Climate Relationships"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Astrophysics," "Tides," "Solar Radiation"; LEARNING DIRECTORY: "Solar Radiation," "Solar Atmosphere," "Solar Flare," "Solar Heat," "Gravity, Law"; area and building audiovisual catalogs: "Solar Radiation," "Solar Physics").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that earth and other planets revolve around the sun	P	G1 K4 K6	4			
3. The student knows causes of day and night on earth in terms of the earth's rotation.	P	K8	4			
4. The student knows the difference between solar time, sidereal time, and standardized time units.	I U H	K2 K5	3 4			
5. The student knows that the world's time zones are based on the position of the earth relative to the sun.	I U H	K2 K6	3 4			

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.5 Dynamics (forces, motion, and time) (Cont.)						
6. The student knows how longitudinal measurements are related to time measurements (e.g., meridians and time zones).	I U H	K2 K10	3 4			
7. The student knows that there is an hour change in time about every 15 degrees change in longitude from 0 degree longitude at Greenwich, England.	I U H	K2 K6	3 4			
8. The student knows that the standardization of time into one hour zones causes a deviation of sidereal time from solar time of as much as 50 minutes.	I U H	K2 K5	3 4			
9. The student knows that the deviation of sidereal time from solar time can be nearly 2 hours during daylight saving time.	I U H	K2 K5	3 4			
10. The student is able to determine longitude from time zone differences.	I U H	P35	2 3			
11. The student is able to determine time of day in another time zone from differences in longitude.	I U H	P35	2 3			
12. The student is able to translate given time from one time zone to another.	I U H	P35	2 3			
13. The student knows that the time the earth takes to orbit the sun (one year) is not an integral number of times that the earth revolves about its own axis (one day).	P I U H	K2 K4 K10	3 4			

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.5 Dynamics (forces, motion, and time) (Cont.)						
14. The student knows that leap year occurs every four years, when an extra day is added to the standardized calendar.	P I	K2 K4	3 4			
15. The student knows that a leap second is an extra second added to compensate for differences between precise time measurements based on different standards.	H	K2 K4 K7	3 4		2.2.1.5	
16. The student knows that in space travel the fourth dimension, time, is a factor to be considered in directional calculations.	U H	K2	3 4		2.2.1.5	
17. The student knows the historical development of calendars (Julian and Gregorian) including the origin of the names of the months and days of the weeks and the part that the moon played in this development.	P I U	K4	1 4	1		(C)Measurement (C)History of Science (V)Respect for others (V)Organization (V)Culture
18. The student knows that the earth in its orbit around the sun reaches its perigee (closest point) in January and its apogee (farthest point) in June.	U H	K2 K4 K6	3 4			
19. The student knows that sidereal time is based upon the earth's rotation on its axis in relation to the stars.	I U H	K2	3 4			

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.5 Dynamics (forces, motion, and time) (Cont.)						
20. The student knows that the Foucault pendulum is used to show that the earth rotates; also, its direction of rotation and rate of rotation at a given latitude.	I U H	K2	3 4			
21. The student knows that the quantity of mass-energy in the universe never changes even though its distribution does change.	U H	G1 K3	3 4		5.1.2	(C)Energy
22. The student knows that celestial objects remain in motion because of inertia.	H	G1 K8	3 4		5.3	
23. The student knows that inertia is defined as the tendency of an object to continue moving in a straight line unless acted upon by an outside force.	H	G1 K2	3 4		5.3	
24. The student knows that force is directly proportional to mass and acceleration (F=m·a).	H	G1 K2	3 4			(C)Force
25. The student knows that inertia and gravity keep orbiting objects such as moons, satellites, and planets in their orbits.	H	G1 K2	3 4			
26. The student knows that the law of universal gravitation states that matter attracts matter in direct proportion to their masses and inversely proportional to the square of the distance between them.	H	G1 K2	1 3 4			(C)Scientific law (C)History of science (V)Unity (V)Nature

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.5 Dynamics (forces, motion, and time) (Cont.)						
27. The student knows that the law of universal gravitation is used to help explain celestial orbital movements.	U H	K2	1 3 4			(C)History of science (C)Scientific law (V)Unity (V)Nature (V)Inquiry
28. The student knows that Keppler's third law states that the square of the period's revolution is proportional to the cube of the mean distance to the sun. (If the period of revolution (P) is in astronomical units, $P^2 = A^3$).	H	G1 K6	1 3 4	1		(C)History of science (C)Scientific law (V)Respect for others (V)Inquiry

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.6 Space travel						
1. The student knows the location and use of print and nonprint materials related to space travel (e.g., card catalog: "Space Flight," "Interplanetary Voyages," "Space Vehicles"; SUBJECT GUIDE TO BOOKS IN PRINT: "Space Flight," "Space Stations," "Navigation (Astronautics)"; READER'S GUIDE: "Space Vehicles," "Space Flight," "Manned Flights to the Moon"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Space Vehicles," "Space Flight"; LEARNING DIRECTORY: "Space Flight," "Space Travel," "Lunar Exploration"; area and building audiovisual catalogs: "Interplanetary Voyages," "Space Flight").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that rocket engines are the only present means of propulsion in outer space travel.	P I	K7	4		5.5	
3. The student knows conditions that space travel equipment must be designed around (e.g., lack of atmosphere, variation in gravitational pull and weightlessness, extremes in temperature and pressure, hazards from radiation and meteoroids, limited space in which to work, need to store food and water, and need to eliminate waste materials).	P I U H	K9	1 4			(C)Technology (C)Research (V)Respect for others (V)Problem solving (V)Complexity

6. Earth and space sciences
6.1 Astronomy

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.1.6 Space travel (Cont.)						
4. The student knows the orbital and escape velocity of the earth (e.g., orbital is between 17,000 and 24,000 miles per hour; escape velocity is over 24,000 miles per hour).	U H	K3	4			
5. The student knows that orbital and escape velocities are attained by using multistage rockets.	U H	K7	4			
6. The student knows the historical development of the space program in the United States and other countries (e.g., manned vs. unmanned, thrust capabilities, size of pay loads, duration of flight, life support systems, lives of astronauts).	P I U H	K4	1 4	1		(C)History of science (V)Respect for others (V)Social perspective

6. Earth and space sciences

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2 Meteorology						
1. The student knows the location and use of print and nonprint materials related to meteorology (e.g., card catalog: "Meteorology"; SUBJECT GUIDE TO BOOKS IN PRINT: "Meteorology-History"; LEARNING DIRECTORY: "Meteorology-History"; area and building audiovisual catalogs: "Meteorology").	P I U H	K6	3		2.1.1.2 7. 3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.1 History of meteorology						
1. The student knows that meteorology is the study of weather.	P I	K1 K2	3 4	3	8.2	
2. The student knows ways in which weather affects human life (e.g., activities, clothing, shelter).	P	K8	4			
3. The student knows ways in which humans historically and currently protect themselves from or take advantage of weather conditions.	P I	K7	4			
4. The student knows ways that humans have attempted to explain, predict, and control weather in various times and cultures (e.g., mythology, magic, religious ritual).	P I U H	K7	4			
5. The student knows principles and procedures which distinguish meteorology from magic or myth.	P I U H	K2 K9	4			(C)History of science
6. The student knows historic and current contributions to the development of meteorological science and technology.	P I U H	K4	4			(C)History of science (C)Technology

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.2 Origin and structure of atmosphere						
1. The student knows the location and use of print and nonprint materials related to origin and structure of atmosphere (e.g., card catalog: "Atmosphere," "Air," "Atmosphere, Upper," "Stratosphere"; SUBJECT GUIDE TO BOOKS IN PRINT: "Atmosphere, Upper," "Atmospheric Pressure"; READER'S GUIDE: "Atmosphere," "Counterglow," "Atmosphere, Upper"; APPLIED SCIENCES AND TECHNOLOGY INDEX: "Atmosphere," "Atmospheric Tides," "Atmosphere, Upper"; LEARNING DIRECTORY: "Atmosphere," "Atmosphere, Earth," Atmosphere, Physics"; area and building audiovisual catalogs: "Atmosphere," "Atmosphere, Upper").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that the atmosphere is a continuous envelope of air surrounding the solid earth.	P I	K1 K3	3 4		6.3.5.3	
3. The student knows the theory that the atmosphere gradually developed from poisonous gases through the process of photosynthesis and development of an oxidizing atmosphere.	U H	G2 K4	4		4.7	
4. The student knows that air is matter. (It occupies space and has weight.)	P I	G1 K3	4		5.8	

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.2 Origin and structure of atmosphere (Cont.)						
5. The student knows that air exerts pressure (e.g., this pressure is about 15 pounds per square inch at sea level due to the weight of the air above).	P I	G1 K3	4			
6. The student knows the use of mercurial and aneroid barometers, barographs, and altimeters in relationship to measuring air pressure.	I U H	K2 K7	3 4		2.2.2	
7. The student is able to measure air pressure.	I U H	P35	1 2 3		2.2.2	
8. The student knows that air pressure decreases with altitude (e.g., at an altitude of 3½ miles the pressure is about half that of sea level).	I U H	G2 K10	4			
9. The student knows that moist air exerts less pressure than dry air.	I U H	G2 K3	4			
10. The student knows that air is a mixture of gases with nitrogen and oxygen being the main ingredients in the mixture.	P I	K3	4		4.2.1	

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.2 Origin and structure of atmosphere (Cont.)						
11. The student knows that air is a mixture of the following gases: nitrogen, 78.03%; oxygen, 20.99%; argon, .9323%; carbon dioxide; neon; helium; krypton; xenon; hydrogen; methane; and nitrous oxide.	U H	K2 K3	3 4			
12. The student knows that nitrogen and oxygen comprise about 99% of the total mass of gases in the air.	U H	K3	4			
13. The student knows that the atmosphere is divided into temperature zones at different elevations called the troposphere, stratosphere, mesophere, and thermosphere.	U H	K1 K5	3 4		2.2.3 7.2.1	
14. The student knows that there are designated layers of the atmosphere called the ozone layer, chemosphere, and ionosphere based on the types of radiation from the sun which they each absorb.	U H	K1 K5	3 4		2.2.3 7.2.1	
15. The student knows properties which distinguish atmospheric zones and layers.	U H	K5	4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.2 Origin and structure of atmosphere (Cont.)						
16. The student knows the causes of different optical effects resulting from light passing through the atmosphere (e.g., red sunsets and sunrises; blue sky; rainbows; rings halos and coronas around the sun and moon; crepuscular rays; and mirages).	P I	K8	1 4		5.11	(C)Perception (V)Insight (V)Beauty
17. The student knows that radiation of long wave lengths from the sun penetrate the earth's atmosphere, strike the ground and are radiated as still longer wave lengths which are trapped by our atmosphere thereby helping to regulate our temperature ("greenhouse effect").	U H	K8	4		5.11	(C)Regulation
18. The student knows situations that cause the sun to apparently disappear (e.g., solar eclipses).	P I	K6 K8	4			(C)Perception

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.3 Heating and cooling (see also 5.9 Heat and thermodynamics)						
1. The student knows the location and use of print and nonprint materials related to heating and cooling (e.g., card catalog: "Heat," "Temperature," "Thermal Dynamics"; SUBJECT GUIDE TO BOOKS IN PRINT: "Heat," "Atmospheric Temperature," "Heat-Radiation and Absorption"; READER'S GUIDE: "Heat," "Solar Energy," "Atmospheric Temperature," "Global Temperature Changes"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Atmosphere," "Atmospheric Temperature"; LEARNING DIRECTORY: "Heat, Atmosphere, Weather," "Heat, Solar," "Solar Heat"; area and building audiovisual catalogs: "Heat," "Temperature").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that warm air rises and cold air sinks.	P I	G2 K3	4		4.2	
3. The student knows that warm air expands due to increased motion of the molecules and is therefore less dense (lighter) than surrounding cold air.	P I U	K8	4		4.2.1	
4. The student knows relationship of vertical air movements to temperature, pressure, and density.	I U H	K8	4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.3 Heating and cooling (Cont.)						
5. The student knows that the greater the difference in temperature of the air the faster cold air replaces rising hot air, producing different forces and velocities of winds.	I U H	K8	4			
6. The student knows that the adiabatic lapse rate is the lowering of the temperature of ascending dry air (about 5.5° F. per 1000 feet) because of expansion due to lowering pressure.	U H	K1 K8	3 4			
7. The student knows that air will stop ascending as soon as it reaches a point where it has the same temperature as the surrounding air.	P I	G2 K4	4			
8. The student knows that surface air won't ascend if the air above it is warmer.	P I	G2 K4	4			
9. The student knows that a temperature inversion is a condition in which colder air is trapped under a warmer air layer.	P I U	K1 K6	3 4			
10. The student knows causes and effects of temperature inversions (e.g., physical causes; fog, high pollution effects).	P I U	K8	4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.3 Heating and cooling (Cont.)						
11. The student knows that solar energy is the original source of energy causing ocean waves, currents, wind, and weather.	I U H	G1 K4	4			(C)Energy
12. The student knows that land and water absorb and retain heat at different rates, which accounts for the differences in temperature.	P I	G2 K8	4		4.6	
13. The student knows causes of unequal heating of the earth's surface (e.g., the angle that the sun's rays strike the earth, the nature of the earth's surface material--color, texture, phases of matter, and atmospheric conditions--amount of fog, smog, or cloud cover).	U H	K8	4			
14. The student knows the extent and causes of typical diurnal (daily) and nocturnal (nightly) temperature changes in his own area.	U H	K3 K8	1 4			(V)Curiosity (V)Knowledge
15. The student knows that dry, clear areas heat up more, and cool off more, than moist, cloudy areas.	I U	K3 K10	4			
16. The student knows the difference between radiation, conduction, convection, and advection in terms of heat energy transfer.	U H	K1 K5	3 4			(C)Energy

6. Earth and space sciences

6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.4 Moisture						
1. The student knows the location and use of print and nonprint materials related to moisture (e.g., card catalog: "Clouds," "Fog," "Rain and Rainfall"; SUBJECT GUIDE TO BOOKS IN PRINT: "Clouds," "Fog," "Humidity"; READER'S GUIDE: "Hydrologic Cycle," "Clouds," "Snow"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Meteorology," "Rain and Rainfall," "Clouds," "Precipitation (Meteorology)"; LEARNING DIRECTORY: "Meteorology, Cloud," "Water Cycle," "Humidity," "Moisture, Air"; area and building audiovisual catalogs: "Rain and Rainfall," "Clouds," "Water").	P I U H	K6	3		2.1.1.2 7 3.1	(C)Resources (V)Inquiry
2. The student knows that moisture is the amount of liquid (usually water) in a given substance.	P I	K1 K2	3 4			
3. The student knows that the amount of moisture in a given substance is affected by temperature, pressure and the properties of the substance.	I U	K8	4		5.8	

6. Earth and space sciences
6.2 Meteorology
6.2.4 Moisture

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.4.1 Humidity						
1. The student knows that humidity is the amount of moisture present in the air.	I U	K1 K2	3 4			
2. The student knows that relative humidity and dew point can be measured through the use of a wet and dry bulb thermometer (sling psychrometer) and a standard conversion table.	I U	K2	3 4		2.2.1 2.2.2	
3. The student knows that dew point can be found by stirring an ice water mixture into warm water and noting the temperature at which condensation first appears on the warm water container.	I U	K2 K7	3 4			
4. The student is able to determine relative humidity and dew point.	I U	P35	2 3			

6. Earth and space sciences
6.2 Meteorology
6.2.4 Moisture

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.4.2 Water cycle (See also 4.2 States of matter)						
1. The student knows that water evaporation is the changing of water into a gas called water vapor.	P I	K1 K2	3 4			
2. The student knows that the rate of evaporation is dependent on temperature and humidity.	P I U	K8	4			
3. The student knows that condensation is the change of a gas to a liquid.	P I	K1 K2	3 4			
4. The student knows that condensation of water depends on temperature and pressure.	P I U	K8	4			
5. The student knows that precipitation is any or all forms of water that fall from the atmosphere to the earth.	P I	K1 K2	3 4			
6. The student knows the progression of the water cycle (e.g., evaporation of water from the ocean, transported as water vapor over the land, condensation, precipitation on land, run off from land to ocean and continuing in that pattern).	P I U	K4	4		6.3.5.2 3.4.3.2	

6. Earth and space sciences
6.2 Meteorology
6.2.4 Moisture

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.4.3 Clouds and fog						
1. The student knows that clouds form when water vapor cools and condenses on particles in the air.	P I U	K4 K8	4			
2. The student knows that clouds are classified by shape and altitude.	P I U	K1 K5	3 4			
3. The student knows different types of clouds (e.g., cumulus, stratus, cirrus, and nimbus) and the characteristics which distinguish them.	I U H	K1 K5	3 4			
4. The student knows weather conditions associated with various types of clouds.	I U H	K5	4			
5. The student knows the types of precipitation from cloud types (e.g., sudden showers from vertical clouds).	I U H	K5	4			
6. The student is able to predict local weather conditions associated with the different types of clouds.	U H	P51	1 2 3		6.2.8	(V)Prediction (V)Resourcefulness (V)Utility
7. The student knows the methods of "seeding" clouds to produce precipitation.	H	K7	4		6.2.9	
8. The student knows that fog is a cloud formed at the surface of the earth.	P I U	K1 K2	3 4			

6. Earth and space sciences
6.2 Meteorology
6.2.4 Moisture

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.4.4 Precipitation						
1. The student knows that dew is condensation of water vapor on the ground, at temperatures above freezing (32°F.).	P I	K1 K2	3 4			
2. The student knows that frost is condensation of water vapor at temperatures below freezing (32°F.).	P I	K1 K2	3 4			
3. The student knows forms of precipitation (e.g., rain, freezing rain, sleet, hail, snow), and the conditions which produce them.	P I U	K1 K5 K8	3 4			
4. The student knows that yearly rainfall varies from place to place.	P I	G2 K6	4			
5. The student knows the yearly rainfall of the local geographic area compared with that of other areas.	I U	K3	4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.5 Storms						
1. The student knows the location and use of print and nonprint materials related to storms (e.g., card catalog: "Storms," "Cyclones," "Thunderstorms," "Typhoons," "Tornadoes"; SUBJECT GUIDE TO BOOKS IN PRINT: "Storms," "Blizzards," "Hurricanes," "Tidal Waves," "Weather"; READER'S GUIDE: "Storms," "Hurricanes," "Tornadoes"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Storms," "Dust Storms," "Magnetic Storms," "Hurricanes"; LEARNING DIRECTORY: "Air Mass," "Weather Front," "Weather, Storm"; area and building audiovisual catalogs: "Storms," "Hurricanes," "Winds").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.2 Meteorology
6.2.5 Storms

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.5.1 Air masses and fronts						
1. The student knows that air masses are large volumes of air that take their characteristics from the earth's surface.	I U H	K1 K2	3 4			
2. The student knows that air masses are classified according to the temperature and humidity of their origin. (The temperature classifications are: Arctic, Antarctic, Polar, Tropical, and Equatorial. The humidity classifications are: Maritime and Continental.)	I U H	K5	3 4			

6. Earth and space sciences
6.2 Meteorology
6.2.5 Storms

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.5.2 Violent storms						
1. The student knows that small storms are caused by small scale motions of the atmosphere.	I U	K8	4			
2. The student knows the principal characteristics, causes, and destructive potential of hurricanes, cyclones, tornadoes, typhoons, monsoon winds, and thunderstorms.	I U H	K1 K5 K8	4			
3. The student knows that lightning is a result of negative electrical charges building up in storm clouds.	I U H	K8	4		5.13.2	
4. The student knows theories explaining how the differences in electrical charges are built up.	H	K8	4		5.13.2	
5. The student knows that thunder is the sound or shock wave produced by the sudden expansion of air during electrical discharge in storm clouds (lightning).	I U H	K1 K2	4			
6. The student knows that lightning often strikes the tallest object in an area (e.g., during a lightning storm a person should not position himself near a tall object unless it is properly grounded).	I U H	K3	4			
7. The student knows precautions which may be taken to prevent or limit storm damage in various situations.	I U H	K7	1 4	2		(V)Resourcefulness (V)Survival (V)Physical well-being (V)Utility

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.6 Winds						
1. The student knows the location and use of print and nonprint materials related to winds (e.g., card catalog: "Wind," "Storms," "Typhoons"; SUBJECT GUIDE TO BOOKS IN PRINT: "Winds," "Monsoons," "Solar Wind," "Hurricanes"; READER'S GUIDE: "Winds," "Whirlwinds," "Wind-pressure," "Tornadoes"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Winds," "Storms," "Wind Pressure"; LEARNING DIRECTORY: "Wind," "Wind Circulation," "Wind Belt," "Wind, Cause"; area and building audiovisual catalogs: "Winds," "Hurricane," "Storms").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that air moves constantly from places of greater pressures (called "highs" to places of lesser pressure (called "lows") because places of lesser pressure are pockets of warm, rising, air.	I U H	K1 K4 K8	4		6.2.3	
3. The student knows that rising and falling air currents (winds) are due to unequal heating of the earth's surface.	I U H	K8	4		6.2.3	
4. The student knows the ways in which winds are helpful and harmful to humans.	P I	K8	4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.6 Winds (Cont.)						
5. The student knows that the rotation of the earth causes winds blowing toward the equator to be deflected to the west while winds blowing from the equator are deflected to the east.	U H	G1 K8	4			
6. The student knows that the rotational force affecting wind systems is known as the Coriolis Force.	U H	G1 K1	4			
7. The student knows that in the United States air masses generally move from west to east due to the direction of rotation of the earth.	U H	K4 K8	4			
8. The student knows that within air masses in the northern hemisphere, winds blow clockwise out of a high pressure area and counterclockwise into a low pressure area.	U H	K4	4			
9. The student knows the names and characteristics of different ranges of wind velocities according to the Beaufort Scale.	U H	K1 K5	3 4			
10. The student knows ways in which people have historically harnessed and used the wind's energy (e.g., windmill, sailing).	P I U H	K4 K7	4			(C)Technology

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.6 Winds (Cont.)						
11. The student knows current research and technological developments related to use of wind as an energy source.	I U H	K7	4			(C)Technology
12. The student knows the uses of various wind measurement devices (e.g., weather balloons, wind vanes, wind socks, and anemometers), and the principles upon which they function.	P I U H	K2 K7	1 3 4		2.2.1 2.2.2	(C)Measurement (C)Technology (V)Utility (V)Knowledge
13. The student is able to measure wind speed and direction.	P I U H	P35	1 2 3			(V)Resourcefulness (V)Utility (V)Inquiry
14. The student knows that sea breezes (wind from sea to land) result from greater heating of the air above land during daylight hours.	I U H	K1 K8	3 4			
15. The student knows that land breeze (wind from land to sea) results from more rapid cooling of air over land than sea.	I U H	K1 K8	3 4			
16. The student knows causes of daytime valley breezes (wind up the slope of a mountain).	I U H	K1 K8	3 4			
17. The student knows causes of nighttime breezes (wind down the slope of a mountain).	I U H	K1 K8	3 4			

6. Earth and space sciences

6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.6 Winds (Cont.)						
18. The student knows that more rain falls on the windward side of a mountain (side wind blows from) than the leeward side because the moisture in the air condenses as the air rises (and cools) to go over the mountain.	I U H	K1 K8	3 4			
19. The student knows that pressure gradient is the rate of change of barometric pressure from a low to a high.	U H	K1 K2	3 4			
20. The student knows that change in barometric pressure is shown on a weather map by the relative closeness of the isobars. (The steeper the pressure gradient--closer isobars--the stronger the wind.)	U H	K2	3 4		6.2.8	
21. The student knows the ways in which the jet stream and upper atmosphere disturbances affect our weather.	U H	K7	4			
22. The student knows that the jet stream is a powerful but narrow stream of fast moving air associated with the westerlies of the upper troposphere.	U H	K7	4			
23. The student knows ways in which the jet stream is used.	U H	K7	4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.7 Climate						
1. The student knows the location and use of print and nonprint materials related to climate (e.g., card catalog: "Climate," "Forest Influences," "Seasons," "Physical Geography"; SUBJECT GUIDE TO BOOKS IN PRINT: "Climatology," "Bioclimatology," "Climatology, Medical"; READER'S GUIDE: "Climate," "Weather-Mental and Physiological Effects," "Paleoclimatology"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Climatology," "Climatology, Medical"; LEARNING DIRECTORY: "Climate, World," "Climate Change," "Season, Cause"; area and building audiovisual catalogs: "Climate," "Forest Influences," "Seasons").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that weather is the moment to moment change in atmospheric conditions.	P I	K2	3 4			
3. The student knows that climate is the total of all weather that has occurred at a given place.	P I	K2	3 4			
4. The student knows climate reporting involves averages of weather conditions, the extremes, and total precipitation for specified periods of time.	P I	K2 K3	1 3 4	1 3	8.2	(C)Data representation (V)Respect for others (V)Inquiry

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.7 Climate (Cont.)						
5. The student is able to distinguish between climate and weather.	P I	P45	2 3			
6. The student knows factors that determine the climate of an area, including latitude, size of land mass, land surface features, elevation, prevailing winds, and distance from bodies of water.	I U H	K8	4			
7. The student knows reasons why the seasonal variations of climate occur only in the temperate regions of the earth.	I U H	K8	4			
8. The student knows the climatic conditions existing at the time of equinoxes and solstices in different geographical areas of the earth.	U H	K3	4			
9. The student knows how climate in certain areas affects humans (e.g., Arctic, desert).	P I U H	K8	1 4	2		(V)Self-knowledge (V)Diversity
10. The student knows that climatology is the study of climates.	I U H	K1 K2	3 4	3	8.2	

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.8 Weather forecasting						
1. The student knows the location and use of print and nonprint materials related to weather forecasting (e.g., card catalog: "Weather Forecasting," "Meteorology in Aeronautics," "Weather Lore"; SUBJECT GUIDE TO BOOKS IN PRINT: "Weather Forecasting," "Meteorology in Aeronautics," "Weather Lore"; READER'S GUIDE: "Weather Forecasting," "U.S.-National Weather Service," "Weather Lore"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Weather Forecasting," "Weather Maps"; LEARNING DIRECTORY: "Weather Forecasting," "Weather Map," "Weather Forecasting Satellite"; area and building audiovisual catalogs: "Weather Forecasting").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows how to record daily weather conditions at specified times (e.g., temperature, air pressure, wind speed and direction, cloud type and cover, relative humidity, dew point, type and amount of precipitation during the past 24 hours, maximum and minimum temperature during the past 24 hours if the instruments are available).	U H	K2	3 4			(C)Data representation

6. Earth and space sciences

6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.8 Weather forecasting (Cont.)						
3. The student is able to map weather conditions using standard symbols (e.g., isobars, isotherms, fronts, type and amount of precipitation, wind speed and direction, local temperature and dew point, cloud type, height and amount of cloud cover, visibility, local air pressure and whether it is increasing or decreasing).	U H	P35	1		2.2.3	(C)Data representation (C)Mapping (V)Resourcefulness (V)Clarity
4. The student is able to decode weather maps.	U H	P41	1 2 3		7.2	(C)Data interpretation (V)Accuracy (V)Resourcefulness
5. The student knows the function and use of weather measurement instruments (e.g., rain gauge, hygrometer, thermometer, wet and dry bulb thermometer, thermograph, sling psychrometer, maximum-minimum thermometer, ceilometer, ceiling balloon, theodolite, and radiosonde).	I U H	K2 K7	1 3 4	1	2.2.2	(C)Tools (V)Resourcefulness (V)Utility (V)Accuracy
6. The student knows sources of information needed to determine air mass movements (e.g., weather stations, weather ships, and satellites).	U H	K2 K7	3 4			

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.8 Weather forecasting (Cont.)						
7. The student is able to predict changes in local weather from current data (i.e., observations of current weather conditions, readings from local weather instruments, and information from the U. S. Weather Bureau about air masses moving toward his or her locality).	U H	P51	1 2 3			(V)Resourcefulness (V)Utility (V)Self-confidence
8. The student knows that data collecting, recording, and reporting are carried out by organizations throughout the world.	P I U	K2 K7	1 3 4			(C)Research (V)Cooperation (V)Internationalism
9. The student knows that a daily record of the condition of the atmosphere can be used to predict the weather.	P I	K2 K7	3 4			
10. The student knows that a weather map is a visual representation of past, present, or future weather for an area.	P I	K2	3 4			(C)Data representation (C)Mapping
11. The student knows that a weather map includes a record of locations of large air masses showing high and low atmosphere pressure regions.	P I U	K2 K3	3 4			
12. The student knows the meaning of the symbols used on a weather map.	P I	K2	3 4		2.2.3 7.2	(C)Mapping

6. Earth and space sciences
6.2 Meteorology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.2.9 Weather control						
1. The student knows that scientists, engineers, and various organizations (companies, agencies) are currently engaged in research, development, and testing of technological means of controlling or regulating weather.	I U H	K7	1 4	1 3	8.2	(C)Research (C)Technology (V)Respect for others (V)Utility
2. The student knows purposes of various weather control systems now being used or developed (e.g., cloud seeding).	I U H	K7	4			(C)Technology
3. The student knows principles upon which various weather control devices or systems are based.	I U H	K2	4			
4. The student knows ways in which humans have attempted to control weather in the past (e.g., magic, technology).	I U H	K4	1 4	1		(V)Respect for others (V)Insight
5. The student knows social, political, economic, or scientific issues related to weather control systems (e.g., regional conflicts).	I U H	K3	1 4		Appendix I	(V)Social concern
6. The student is able to analyze or clarify issues related to weather control.	I U H	P43 P63	1 2 3 5		1.1.3.2 2.1.5	(V)Problem solving (V)Critical judgment

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.1 History of geological sciences						
1. The student knows the location and use of print and nonprint materials related to history of geology (e.g., card catalog: "Geology," "Geologists," "Geology, Stratigraphic"; SUBJECT GUIDE TO BOOKS IN PRINT: "Geology," "Geology-History," "Geology, Stratigraphic," "Geologists"; READER'S GUIDE: "Geologists," "Geological Time," "Geology-History"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Geology," "Geologists," "Geology, Stratigraphic"; LEARNING DIRECTORY: "Geology," "Geology-History," "Geology,Stratigraphic"; area and building audiovisual catalogs: "Geology," "Geology, Stratigraphic").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that geology is the science of the earth, its processes, its forms, and its relationships to other physical sciences.	I U H	K1 K2	3 4			
3. The student knows that geology is a discipline within the field of earth science and includes several subdisciplines (e.g., geophysics, historical geology, paleontology, stratigraphy, mineralogy, seismology, engineering and mining geology).	I U H	K2	3 4	3	8.2	

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.1 History of geological sciences (Cont.)						
4. The student knows historic developments, discoveries, and uses of geologic sciences.	I U H	K4	4	3	8.2	(C)History of science
5. The student knows contributions of historic and current geologists (e.g., Powell, Wegner).	I U H	K4	1 4	1		(C)Research (V)Respect for others (V)Inquiry
6. The student knows principles and theories basic to geologic sciences (e.g., uniformitarianism, evolution).	I U H	G1 K2	4			(C)Scientific law (C)Theory
7. The student knows reasons why current geologic research is often interdisciplinary (e.g., research in plate tectonics).	U H	G2 K8	1 4	1		(C)Research (V)Cooperation (V)Utility (V)Problem solving (V)Complexity (V)Interdependence

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2 Earth's structure (physical geology						
1. The student knows the location and use of print and nonprint materials related to earth (e.g., card catalog: "Creation," "Natural History," "Geology-Maps," "Force and Energy"; SUBJECT GUIDE TO BOOKS IN PRINT: "Earth-Age," "Earth-Rotation," "Earth Sciences"; READER'S GUIDE: "Earth-Internal Structure," "Earth-Orbital Motion," "Creation"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Earth-Crust," "Earth Currents," "Earth Movements," LEARNING DIRECTORY: "Earth-Crust," "Earth, Evolution," "Earth, Magnetic Pole," "Earth, Measurement"; area and building audiovisual catalogs: "Earth").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows measurements used to study earth's structure (e.g., length, volume, mass).	I U H	K2	3 4		2.2.1	(C)Research (C)Measurement
3. The student knows dynamics (motions, forces) affecting earth's structure.	I U H	G1 K8	4		6.1.5 5.4	
4. The student knows ways in which physical laws, principles, and theories about energy-mass relate to the study of earth dynamics, earth structure, and geologic processes.	H	G1 K2	4		4.5 4.8 6.3.3	(C)Energy

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.1 Interior						
1. The student knows the main layers of the earth (e.g., crust, mantle, outer core, inner core).	P I U H	K1 K5	3 4			
2. The student knows characteristics of the earth's interior layers (e.g., chemical composition, state of matter, relative thickness of layer).	P I U H	K3	4			
3. The student knows ways in which data about the earth's interior are collected.	P I U H	K2 K7	3 4			(C)Research
4. The student is able to interpret diagrams representing the earth's interior structure.	P I U	P41	1 2 3			(C)Data representation (V)Resourcefulness (V)Accuracy

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.2 Crust						
1. The student knows that the earth's crust is relatively thin.	P I	K3	4			
2. The student knows that the earth's crust is divided into a number of segments called plates.	P I U	K1 K3	3 4		6.3.3.2	
3. The student knows "plate tectonics" refers to the study of crustal plates and their movements, and the theory developed to explain them.	I U H	K1 K2	3 4		6.3.3.2	
4. The student knows characteristics or properties distinguishing the earth's crust from other layers.	P I U H	K5	4			
5. The student knows selected data related to composition and distribution of chemicals in the earth's crust.	U H	K3	4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.3 Surface features						
1. The student knows sciences involved in the study and mapping of the surface features on the earth's crust, including geomorphology, topography, cartography, oceanography, physical geography, etc.	I U H	K1 K7	4	3	8.2	(C)Research
2. The student knows methods used in various sciences to acquire, represent and interpret information about the earth's surface features.	I U H	K2 K7	1 4	1		(C)Data representation (C)Data interpretation (C)Research (V)Respect for others (V)Inquiry (V)Utility
3. The student knows meaning of terms used to identify gross surface features, including continent, land mass, ocean, seas, etc.	P	K1 K2 K6	1 3 4		7.2	(V)Communication (V)Clarity
4. The student knows the approximate proportion of land to water on the earth's surface.	P I	K3	4			
5. The student is able to distinguish between land and water on a map or globe.	P	P45	1 2 3			(V)Resourcefulness (V)Accuracy

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.3 Surface features (Cont.)						
6. The student knows names and characteristics which distinguish various kinds of land and water formations, including hills, mountain ranges, valleys, plains, plateaus, rivers, bays, islands, etc.	P I	K1 K5	1 3 4		7.2	(V)Communication (V)Clarity (V)Diversity
7. The student knows meanings of terms used in describing land forms, including contour, relief, shape, size, topography, etc.	P I	K1 K2	1 3 4		7.2	(V)Communication (V)Clarity (V)Diversity
8. The student knows meanings of terms used to represent measurements of surface features, including depth, elevation, incline, distance, etc.	P I	K1 K2	1 3 4		7.2	(V)Communication (V)Clarity (V)Organization
9. The student knows various kinds of maps and models used to represent the earth's surface features (e.g., relief maps and globes, topographic maps).	P I	K2 K5	3 4		6.3.6 7.2	(C)Data representation
10. The student knows symbols, colors, etc., conventionally used to represent sizes and shapes of earth features in various kinds of maps and models (e.g., contour lines, colors coded by elevation).	P I U H	K2	1 3 4			(V)Communication (V)Clarity (V)Organization
11. The student is able to interpret shapes and sizes of land or water forms from their representation in maps or models.	P I U H	P41	1 2 3			(V)Accuracy (V)Utility

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.4 Minerals						
1. The student knows the location and use of print and nonprint materials related to minerals (e.g., card catalog: "Mineralogy," "Mines and Mineral Resources," "Crystallography"; SUBJECT GUIDE TO BOOKS IN PRINT: "Mineralogy," "Crystallography"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Mineralogy," "Minerals-Nomenclature"; LEARNING DIRECTORY: "Mineral, Fluorescent," "Mineral Hardness"; area and building audiovisual catalogs: "Mineralogy").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that minerals are naturally occurring inorganic compounds that make up the rocks of the earth.	I U	K1 K3	3 4		4.1.4.2	
3. The student knows characteristics and properties common to minerals (e.g., crystalline molecular structure).	I U	K3	4		4.2.3.1	
4. The student knows that not all minerals show flat crystal faces.	I U	K3	4			
5. The student knows that the shape of crystals in minerals depends on the direction and number of force fields that emanate from each molecule.	I U H	K8	4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.4 Minerals (Cont.)						
6. The student knows kinds of crystal systems in minerals (e.g., isometric, tetragonal, hexagonal, orthorhombic, monoclinic, and triclinic).	H	K5	3 4			
7. The student knows that there are many kinds of minerals (over 2,000 in the earth's crust).	P I	G2 K5	1 4			(V)Diversity
8. The student knows structural characteristics by which minerals are classified and named.	P I U	K5 K9	3 4			
9. The student knows names and properties of various common minerals.	P I U H	K1 K3	3 4			
10. The student is able to use conventional scientific names for minerals being studied or collected.	I U H	P31 P41 P66	1 2 3			(V)Communication (V)Accuracy (V)Clarity
11. The student is able to use pictured keys or descriptive references as guides to classifying or identifying common minerals by their physical appearance.	P I U	P41 P45	1 2 3			(V)Resourcefulness (V)Utility

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.4 Minerals (Cont.)						
12. The student knows that minerals may be identified by using tests of their chemical and physical properties.	I U H	K7	3 4			
13. The student knows ways of testing for selected minerals (e.g., color, luster, crystal shape, streak, fracture, cleavage, hardness, specific gravity, magnetism, fluorescence, phosphorescence, double refraction, acid test, radioactivity, flame test, bead test, taste, solubility).	H	K2 K7	3 4			
14. The student is able to use conventional testing procedures, materials, and equipment to identify unknown minerals.	H	P43 P47	1 2 3			(V)Resourcefulness (V)Utility
15. The student knows ways in which minerals are formed.	I U H	K4 K7	4			
16. The student knows why particular minerals are usually found in particular kinds of land forms or structures.	I U H	K6 K8	4			
17. The student knows land forms or structures commonly associated with minerals being studied.	I U H	K6 K10	4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.4 Minerals (Cont.)						
18. The student knows that minerals are found in fresh and salt water.	P I	K6	4		6.4.3.1	
19. The student knows that minerals in the earth's water systems come mainly from land forms through erosion.	P I	K6 K7	4		6.3.3.3	
20. The student knows that mineral deposits are found under the ocean.	P I	K6	4		6.4.2	
21. The student knows that minerals are present in living systems.	P I	K6	4			
22. The student knows the names of the minerals most commonly found in an area being studied.	I U H	K1	3 4		2.2.3 7.2	
23. The student knows the relationship between specific minerals in an area and the geological land forms in which they occur.	I U H	K6 K10	4			
24. The student knows ways in which various minerals are discovered, extracted and used.	I U H	K2 K7	3 4		6.3.7.2	

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks						
1. The student knows the location and use of print and nonprint materials related to rocks (e.g., card catalog: "Rocks"; SUBJECT GUIDE TO BOOKS IN PRINT: "Rocks," "Precious Stones"; READER'S GUIDE: "Rocks, Igneous," "Rocks," "Rocks, Crystalline and Metamorphic"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Rocks, Igneous," "Rocks, Sedimentary"; LEARNING DIRECTORY: "Meteorite," "Rock Classification"; area and building audiovisual catalogs: "Rocks").	I U H	K6 K7	3 4		2.1.1.2 7.3.1	
2. The student knows that a rock is a mineral or aggregate of minerals forming an essential part of the earth's crust.	P I U H	K2	3 4			
3. The student knows properties common to rocks.	P I U H	K3	4			
4. The student knows the major categories of rocks--igneous, sedimentary, metamorphic, extraterrestrial.	P I	K2 K5	3 4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks (Cont.)						
5. The student knows that igneous rocks are those formed by cooling of molten material from the earth's interior.	P I	K2	3 4		6.3.3.1	
6. The student knows names, properties and major kinds igneous rocks (e.g., obsidian, dense, glassy; quickly cooled lava).	P I U	K5	3 4		6.3.3.1	
7. The student is able to identify igneous rocks in his or her region.	P I U	P31 P45	1 2 3			(V)Resourcefulness (V)Accuracy (V)Organization
8. The student is able to distinguish igneous rocks from other kinds of rock.	P I U	P45	2 3			
9. The student knows economic uses of igneous rocks.	P I U	K7	4		6.3.7.2	
10. The student knows that sedimentary rocks are those formed by accumulation of sediment from water or air.	P I	K2	3 4			
11. The student knows that sediment may consist of particles of rock fragments, remains of animals or plants, and/or partially dissolved chemicals.	P I	K2	3 4			
12. The student knows that a characteristic feature of sedimentary rocks is a layered structure known as bedding or stratification.	P I	K3 K1	3 4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks (Cont.)						
13. The student knows that many layers of sedimentary rocks contain fossils.	P I	K3 K6	4		6.3.4.3	
14. The student knows that layers in a sedimentary section are called beds or strata.	P I U	K2	3 4			
15. The student knows that sedimentary beds are deposited in flat or nearly flat layers.	P I U	K3	4			
16. The student knows that organic sedimentary rocks include limestone, diatomaceous rocks, and coal.	I U H	K1 K5	3 4			
17. The student knows that chemical sedimentary rocks include limestone, dolomite, gypsum, and rock salt.	I U H	K1 K5	3 4			
18. The student knows that clastic sediments are classified and named according to size: boulders, cobbles, pebbles, granules, sand, silt, and clay.	I U H	K1 K5	3 4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks (Cont.)						
19. The student knows the processes through which coal is formed.	I U H	K7	4			
20. The student knows that coal is organic sedimentary rock consisting of the altered remains of plants.	I U H	K2	3 4			
21. The student knows that there is a direct relationship between the amount of carbon present in coal and its economic importance.	I U H	K8	4		6.3.7.2	
22. The student knows that petroleum and natural gas are found in or above porous sedimentary rock, rich in organic fossils, where folding or faulting have created a trap.	I U H	K6	4		6.3.7.2	
23. The student knows the conditions necessary for the formation of petroleum and natural gas (e.g., porous, permeable reservoir rock, impervious cap rock, and a trap).	I U H	K7	4			
24. The student knows that metamorphic rocks are those formed from other rocks by action of heat, pressure, solutions, usually at great depth.	P I	K2	3 4		6.3.3	
25. The student knows that all kinds of rocks can be metamorphosed (e.g., sedimentary, igneous, or other metamorphic rocks).	P I	G2 K3	4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks (Cont.)						
26. The student knows that metamorphism usually brings about changes in the crystalline structure, formation of new minerals, and sometimes a coarsening of texture.	I U H	K8	4			
27. The student knows that metamorphism results from heat, pressure, and reaction with other substances.	I U H	K1 K8	3 4			
28. The student knows that contact metamorphism occurs when molten rock intrudes into a formation and changes the composition of the surrounding material.	U H	K1 K8	3 4			
29. The student knows that regional metamorphism occurs over large scale areas from heat and pressure, or associated with igneous activity.	U H	K1 K8	3 4			
30. The student knows the ways in which the rate of cooling of metamorphic rocks affects the size of the crystals formed (e.g., slow cooling forms large crystals).	P I U H	K8	4			
31. The student knows names and properties of common kinds of metamorphic rocks and their parent rocks (e.g., slate, marble, quartzites, schists, gneiss).	P I U	K1 K5	3 4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks (Cont.)						
32. The student is able to identify metamorphic rocks in his or her region.	P I U	P31 P45	1 2 3			(V)Resourcefulness (V)Accuracy (V)Organization
33. The student is able to distinguish metamorphic rocks from other kinds of rocks.	P I U	P45	2 3			
34. The student knows that rocks not formed in earth are called extra-terrestrial rocks.	P I	K2	3 4			
35. The student knows that extra-terrestrial rocks we can study include meteorites and moon rocks collected by astronauts.	P I	K5	4	1		
36. The student knows that meteorites are rocks that have fallen from outer space.	P I	K2	3 4		6.1.3.6	
37. The student knows that meteorites are a fraction of their original size due to friction and heat loss while traveling through space.	P I	K3 K8	4			
38. The student knows names and characteristics of meteorites (e.g., Willamette meteorite, Arizona meteorite).	P I	K1 K3	4			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.5 Rocks (Cont.)						
39. The student knows that some moon rocks have approximately the same composition as some earth rocks, and others are different.	P I	K3	4			
40. The student knows reasons why scientists are studying rocks from the moon.	P I	K8	1 4			(C)Research (V)Inquiry (V)Knowledge (V)Curiosity (V)The unknown (V)Social concern

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.6 Soils (See also 6.3.5.1 Soil)						
1. The student knows that soils are found in the top layer of the earth's crust.	P I	K6	4			
2. The student knows physical properties common to soils.	P I	K3	4			
3. The student knows components of soil (e.g., chemical composition; materials--parent, substrate, organic).	P I U H	K3	4			
4. The student is able to use conventional terms, procedures, and graphic representations to study the vertical distribution of soils (e.g., soil profiles, horizons, layers).	I U H	P65	3 4			
5. The student knows that soils may be classified by color, porosity, origin, location, chemical composition, or other criteria.	P I U H	K5	3 4			
6. The student knows names and characteristics of conventional categories of soils (e.g., tundra, podsol, chernozem, sierzem, lateritic, clay, humus, loess, sand, duff, litter).	I U H	K1 K3 K5	3 4			
7. The student knows theories related to origins of soils.	I U H	K2	3 4		6.3.3.3	
8. The student is able to classify or identify soils.	I U H	P31 P33	1 2 3			

6. Earth and space sciences
6.3 Geology
6.3.2 Earth's structure (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.2.6 Soils (Cont.)						
9. The student knows that different soils have different acid content (pH).	I U H	K5	3 4		6.3.5.1 4.3.1.1	
10. The student is able to measure the pH of soil.	I U H	P35	1 3 4			(V)Utility (V)Resourcefulness (V)Inquiry
11. The student knows that the pH (acidity-alkalinity) of soil is related to the kinds of plant life growing there.	I U H	G2 K8	3 4			
12. The student knows the difference between topsoil, subsoil, and bedrock.	I U H	K5	3 4			
13. The student knows how the darker color and looser texture of topsoil is related to the presence of decayed plant and animal matter (humus).	I U H	K8	4			
14. The student knows how soil porosity, water retention, and permeability are related to soil particle size.	I U H	K8	4			
15. The student knows soil structure classifications (e.g., columnar, prismatic, blocky, platy).	U H	K5	3 4			

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3 Geologic processes (physical geology)						
1. The student knows the location and use of print and nonprint materials related to geologic processes (e.g., card catalog: "Geophysics," " Physical Geography," "Erosion," "Soils (Engineering)"; SUBJECT GUIDE TO BOOKS IN PRINT: "Vulcanism," "Weathering," "Erosion," "Drift"; READER'S GUIDE: "Earth Movements," "Earthquakes"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Geophysics," "Sedimentation and Deposition," "Weathering (Rocks)"; LEARNING DIRECTORY: "Earth, Physical Change," "Earth Structure," "Earth Surface, Wind Effects," "Earthquakes," "Glacial Epoch"; area and building audiovisual catalogs: "Earthquakes," "Physical Geography," "Volcanoes").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.1 Vulcanism						
1. The student knows that vulcanism refers to the movement of molten rock in the earth's interior.	P I	K2	3 4			
2. The student knows names and distinguishing characteristics of volcanic materials, including magma, lava, dust, cinders, ash, bomb, block.	P I	K1 K3	3 4		2.2.3 7.2	
3. The student knows theories related to the causes of vulcanism and the factors which affect volcanic activity.	P I U H	K2 K8	3 4			(C)Theory
4. The student knows that vulcanism consists of extrusive and intrusive activity.	I U H	K5	3 4			
5. The student knows that intrusive rocks are those that solidify beneath the earth's crust.	I U H	K2	3 4		6.3.2.5	
6. The student knows names and distinguishing characteristics of the structures related to instrusive activity (e.g., batholith, dike, sill, nick, stock).	I U H	K1 K3	3 4		6.3.2.2	
7. The student knows the rock types related to intrusive activity (e.g., granite, diorite, gabbro, pigmatite).	I U H	K5	3 4		6.3.2.5	

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.1 Vulcanism (Cont.)						
8. The student knows that extrusive rocks are those that solidify on top of the earth's crust.	I U H	K1 K2 K5	3 4		6.3.2.5	
9. The student knows meanings of terms related to extrusive volcanic activity (e.g., explosive eruptions, quiet eruptions, flow).	I U H	K1 K2	3 4			
10. The student knows the rock types related to extrusive activity (e.g., rhyolite, obsidian, pumice, andesite, and basalt).	I U H	K5	3 4		6.3.2.5	
11. The student knows names and distinguishing features of structures associated with extrusive activity (e.g., shield, composite, and active volcanoes; cinder cone, plateau, crater, caldera, fissure).	I U H	K1 K3 K5	3 4		6.3.2.3	
12. The student knows the volcanic structures in his or her geographical region.	P I	K3 K6	4		6.3.2.3	
13. The student knows of potential volcanic activity and its effects in his or her area (e.g., Cascade Range).	P I U	K4 K8	4		6.3.2.2	
14. The student knows relationships between vulcanism, earthquakes, and mountain building.	P I U H	K8	4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.2 Crustal movements						
1. The student knows that an earthquake is the movement of the ground produced by the shifting of rocks under the earth's surface.	P I	K2	3 4			
2. The student knows that earthquakes occur when stresses which develop within the earth become too great for the crust to bear.	P I	K8	4			
3. The student knows that nearly all earthquakes occur in fractures of the earth's crust.	P I	K6	4			
4. The student knows the geographic distribution of earthquake occurrences.	P I	K6	4			
5. The student knows that a fault is a break or fracture in the earth's crust along which movement has occurred.	P I	K2	3 4			
6. The student knows that fault lines occur along the interface of two crustal plates or segments.	P I U	K2 K6	3 4			
7. The student is able to identify fault lines from pictures or field observation.	P I U	P45	P33 P44			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.2 Crustal movements (Cont.)						
8. The student knows that when earthquakes occur, shock waves travel through the earth from the center of the quake (epicenter).	P I U	K2 K4	3 4			
9. The student knows that there is a relationship between the velocity of shock waves and the matter through which they travel.	I U H	K8	4			
10. The student knows names and distinguishing characteristics of the common kinds of shock waves (e.g., primary, secondary).	I U H	K5	3 4			
11. The student knows how suboceanic faulting causes seismic sea waves (tidal waves).	I U	K8	4			
12. The student knows how seismographs measure and record intensities of earthquakes (faulting, shock waves).	P I U	K2 K7	3 4			
13. The student knows scales and units commonly used to represent intensities of earthquakes (e.g., Richter Scale, Mercalli Scale).	I U H	K2	3 4			
14. The student is able to interpret seismographic data.	U H	P41	3 4			(C)Data interpretation (V)Resourcefulness (V)Inquiry (V)Utility

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.2 Crustal movements (Cont.)						
15. The student knows how seismographs are used to locate the epicenter of an earthquake.	I U H	K7	3 4			
16. The student knows that studies of earthquakes provide information about the structure of the earth's interior.	I U H	K2 K8	1 3 4			(C)Research (V)Inquiry (V)Respect for others
17. The student knows the effects of earthquakes on human communities.	P I U H	K8	1 4			(V)Social concern (V)Complexity
18. The student knows that the present structure and geography of the continents and ocean basins are the result of the movement of large crustal segments called "plates."	I U H	K8	3 4		6.3.2.2	
19. The student knows names and characteristics of the currently identified continental plates.	I U H	K1 K3 K6	3 4			
20. The student knows movements of the earth's crustal plates are the cause of earthquakes, faults, sea-floor spreading and midocean rises, continental drift, mountain building and vulcanism.	I U H	K8	4			
21. The student knows that plate movement is probably caused by internal processes such as convection cells within the earth's mantle.	I U H	K8	4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.2 Crustal movements (Cont.)						
22. The student knows the evidence which supports the theory of plate tectonics (e.g., magnetic dating of ocean floor).	I U H	K2 K3	3 4		6.3.2.2	(C)Theory
23. The student knows that evidence which supports the theory of continental drift (e.g., shapes of continental shorelines, matching species in presently separated continents, documentation of ocean floor spreading).	I U H	K2 K3	3 4			(C)Theory
24. The student is able to use the conventional terminology of plate tectonics.	I U H	P31 P41 P66	1 2 3		2.2.3 7.1.2	(V)Communication (V)Accuracy (V)Clarity (V)Mastery (V)Resourcefulness
25. The student knows ways in which studies of plate tectonics and continental drift are affecting studies in other sciences (e.g., anthropology, archaeology, historical geology, life sciences, seismology).	I U H	K8	1 3	1 3	6.3.4 8.2.5	(C)Research (C)Theory (V)Respect for others (V)Inquiry (V)Accuracy (V)Inter-relatedness (V)Complexity (V)The unknown
26. The student knows that mountains are formed by folding and faulting.	P I U	G1 K7	4		6.3.2.3	

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.2 Crustal movements (Cont.)						
27. The student knows the identifying characteristics of volcanic and folded mountains.	P I U	K3 K5	4			
28. The student is able to use accurately conventional terms related to folding and faulting of the earth's crust: (e.g., fracturing, anticline, syncline, folds, dip, faults).	P I U	P31 P41 P66	1 2 3		2.2.3 7.1.2	(V)Communication (V)Accuracy (V)Clarity (V)Resourcefulness (V)Mastery
29. The student knows that diastrophism is the process by which the earth's crust is deformed.	I U H	K1 K2	3 4			
30. The student knows results of diastrophism (e.g., folds and faults, continents and ocean basins, plateaus and mountains).	I U H	K8	4			
31. The student knows that orogenesy is the process of forming mountains by folding and faulting.	U H	K1 K2	3 4			
32. The student knows the names, locations, and major characteristics of the geomorphic divisions of a specified area.	U H	K5	3 4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (See also 6.3.5, Earth environments)						
1. The student knows that weathering changes rock to soil.	P I	K7	3 4		6.3.2.6	
2. The student knows different types of weathering (e.g., physical and chemical).	P I	K5	3 4			
3. The student knows the effects of weathering agents.	P I	K8	4			
4. The student knows the ways in which climatic conditions influence weathering.	P I	K8	4			
5. The student knows ways in which rocks are changed (e.g., freezing water, chemicals, water, plant growth and decay, temperature changes, animal activity).	P I	K7	4		6.3.2.5	
6. The student knows that soil is made of weathered rock and organic material.	P I	K3	4		6.3.2.6	
7. The student knows that erosion is the process of wearing away of material.	P I	K1 K2	3 4			
8. The student knows the natural agents of erosion (e.g., gravity, water, ice, wind).	P I	K1 K3	3 4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
9. The student knows causes and effects of erosion.	P I	K8	4			
10. The student knows some systems used to prevent erosion.	P I	K7	1 4	1	6.3.5.1 3.5	(C)Conservation (C)Tools (V)Resourcefulness (V)Utility (V)Respect
11. The student knows the shape and physical characteristics of the basic land features formed by erosion (e.g., domes, mesas, gullies, canyons, shorelines, sand dunes, V-shaped valleys).	P I	K5	3 4			
12. The student is able to identify evidence of erosion from illustrations, descriptive data, or field observation.	P I	P11 P41 P42 P45	1 2 3			(V)Accuracy (V)Resourcefulness (V)Nature
13. The student knows types of gravitational erosion (e.g., mass wasting, land slides, slumps, avalanches).	I U H	K5	3 4		5.4.4	
14. The student knows why water flows downhill.	P I	K8	4			
15. The student knows how running water affects the earth's surface.	P I U H	K8	4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
16. The student knows how material is transported by running water.	I U H	K7	4			
17. The student knows that water sorts sediments according to the mass of particle and speed of water.	I U H	K3 K9	4			
18. The student knows the life span of a river from young stream to old river.	I U H	K4	4			
19. The student knows names and distinguishing characteristics of structures formed by the action of running water.	P I	K5	4			
20. The student knows ways in which running water restructures land forms.	P I	K7 K8	4			
21. The student knows features and functions of lakes, ponds, and swamps.	P I	K3 K7	4			
22. The student knows that the formation of swamps, lakes, brooks. and springs is dependent on the land surface.	P I	K3 K7	4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
23. The student knows that streams, rivers, etc., are parts of large water transport systems (places where water collects and flows downhill in larger and larger amounts).	P I	G2 K6	4			(C)Systems
24. The student knows meanings of terms used to specify water transport systems or their parts (e.g., river system, drainage system, watershed, source, tributary system, storage area, basin ground water).	P I U	K1 K2	3 4		6.3.2.3	
25. The student knows meanings of terms used to specify water-land processes, including erosion, runoff, leaching, precipitation, glaciation, diffusion, deposition.	P I U H	K1 K2	3 4		2.2.3 7.1.2	
26. The student knows that ground water dissolves limestone to form underground caves, stalagmites, and stalactites.	P I	K7	4			
27. The student knows that water table is the level of moisture (ground water) in the soil.	I U	K1 K2	3 4			
28. The student knows the methods used for determining water tables.	I U	K2	3 4			
29. The student knows the economic importance of water tables.	I U	K3	1 3 4			(V)Nature (V)Social concern (V)Utility (V)Complexity

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
30. The student knows the meanings of the terms "simple well" and "artesian well" as they relate to the water table.	I U	K1 K2	3 4			
31. The student knows the effect of freezing and thawing on surfaces.	P I	K8	4		4.2	
32. The student knows ways in which glacial ice is formed.	P I U	K7	4			
33. The student knows the mechanism by which glaciers move.	I U H	K7	4			
34. The student knows effects of glacial action on the surface of the earth.	P I U	K8	4			
35. The student knows land features formed by glacial deposition (e.g., moraines, rills, eskers, kames, erratics).	I U H	K5	3 4			
36. The student knows land features formed by glacial erosion (e.g., cirques, U-shaped valleys and lakes, and aretes).	I U H	K5	3 4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
37. The student is able to identify evidence of glacial erosion or deposition from illustrations, descriptive data or field observation.	I U H	P11 P41 P42 P45	1 2 3			(V)Accuracy (V)Resourcefulness (V)Nature
38. The student knows how an iceberg is formed.	I U H	K7	4			
39. The student knows the erosional effect of wind.	P I U	K8	4			
40. The student knows that wind is an agent of gradation (e.g., sand grains, mud particles).	I U H	K2 K7	3 4			
41. The student knows that wind is the least effective erosional agent.	P I U	G2 K7	4			
42. The student is able to identify evidences of wind erosion from illustrations, descriptive data, or field observation.	P I U	P11 P41 P42 P45	1 2 3			(V)Accuracy (V)Resourcefulness (V)Nature

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
43. The student knows that sediment was once living organisms and bits of eroded materials that have been carried and deposited by water.	P I	K1 K2	3 4		6.3.2.5	
44. The student knows that deposition is the accumulation of sediment.	P I	K1 K2	3 4			
45. The student knows the processes associated with deposition (e.g., sorting, bedding, layering).	P I	K5 K7	3 4		6.3.2.5	
46. The student knows factors affecting the deposition of a particle (e.g., the mass of the particle deposited, speed of the water, structures over which it passes).	I U H	K8 K7	4			
47. The student knows that deltas are the result of sediments deposited by a moving stream which slows upon entering a body of standing water.	I U H	K7 K8	4			
48. The student knows how running water forms oxbows, meanders, waterfalls, alluvial fans, flood plains, terraces, and deltas.	I U H	K7 K8	4			

6. Earth and space sciences
6.3 Geology
6.3.3 Geologic processes (physical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.3.3 Weathering, erosion, deposition (Cont.)						
49. The student knows methods, materials, and instruments used to identify and trace the sources of sediment in a deposit (e.g., gold flakes, pumice from a volcano).	I U H	K2 K7	3 4			
50. The student is able to identify naturally deposited sediments from illustrations, descriptive data, or field observation.	P I U H	P11 P41 P42 P45	1 2 3			(V)Accuracy (V)Resourcefulness (V)Nature
51. The student is able to infer sources of deposited sediments.	I U H	P42	1 2 3			(V)Accuracy (V)Resourcefulness (V)Nature

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4 Earth's history (historical geology)						
1. The student knows the location and use of print and nonprint materials related to historical geology (e.g., card catalog: "Geology, Stratigraphic," "Creation," "Fossils," "Man-Influence of Environment," "Man-Origin and Antiquity"; SUBJECT GUIDE TO BOOKS IN PRINT: "Geological Time," "Paleontology," "Evolution"; READER'S GUIDE: "Man-Prehistoric," "Micro-paleontology"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Paleontology," "Geology, Stratigraphic," "Geology, Structural"; LEARNING DIRECTORY: "Geologic History," "Geological Time," "Geology, Fossil"; area and building audiovisual catalogs: "Evolution," "Fossils," "Time").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources

6. Earth and space sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.1 Geologic time						
1. The student knows that geologic history is classified into epochs, periods, and eras.	I U H	K5	1 4		2.2.1.5	(V)Organization (V)Inquiry (V)Perspective
2. The student knows names of geologic eras and their distinguishing characteristics (e.g., Cenozoic, Mesozoic, Paleozoic).	I U H	K1 K3 K5	3 4			
3. The student knows that the history of the earth prior to the Paleozoic era is referred to as Pre-Cambrian.	I U H	K1 K4	3 4			
4. The student knows that the eras of geologic time were determined by the strata and dominant life forms thought to exist at that time (e.g., Paleozoic--invertebrates, Mesozoic--reptiles, Cenozoic--mammals).	I U H	K9	4			
5. The student knows the geologic development of the earth during specific time periods.	I U H	K4	4			
6. The student knows the development of life on the earth during specific time periods.	I U H	K4	4			(C)Life (C)Evolution

6. Earth and space science
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.1 Geologic time (Cont.)						
7. The student knows some of the major geological events that have taken place in his or her area and their proper place in the sequence of geological time.	I U H	K4	4			
8. The student knows geological evidence indicating that climatic changes have taken place in his or her area (e.g., fossils, glaciation evidence).	I U H	K6 K8	4			
9. The student knows principles and procedures upon which geological time scales are based (e.g., sequential dating of rock).	I U H	G1 K2	3 4		6.3.4.4 6.3.6	
10. The student knows the geologic time scale for his or her own area.	I U H	K2 K6	1 3 4			(V)Perspective

6. Earth and space sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.2 Evolution and variation (see also 3.3.3 Population genetics and 3.4.6 Change through time)						
1. The student knows the theory of evolution has been derived in part from fossil evidence of past life forms.	P I U H	G1 K8	1 4			(C)Theory (C)Evolution (V)Inquiry
2. The student knows that some life forms developed variations in order to adapt to changes in environment.	P I U H	G2 K8	4			(C)Adaptation
3. The student knows that geologic events affected the variation in evolution of life forms.	P I U H	G2 K8	4			
4. The student knows that the study of fossils indicates that the development of life forms has been from simple to complex.	P I U H	G1 K2 K4	4			
5. The student knows theories and hypotheses about why some life forms became extinct.	P I U H	G1 K8	4			
6. The student knows that there are conflicting theories as to why some animals became extinct.	I U H	K10	1 4			(C)Theory (V)Inquiry (V)Complexity (V)The unknown
7. The student knows possible causes of animal extinction (e.g., lack of adaptation to a changing environment in terms of climate, food sources, habitats, catastrophe).	I U H	K4 K10	4			

6. Earth space and sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.2 Evolution and variation (Cont.)						
8. The student knows that some animals have become extinct even though they seemed able to adapt to a changing environment (e.g., dinosaurs).	I U H	K4 K10	4			
9. The student knows that humans are recent animals in geologic time.	P I U	G2 K4	1 4			(C)Evolution (V)Perspective (V)Self-knowledge (V)Nature
10. The student knows scientific theories and hypotheses related to the evolution or origin of human life.	I U H	G1 K4	3 4			(C)Evolution
11. The student knows geologic evidence (e.g., discovery and dating of fossil bones) which supports or has given rise to various hypotheses and theories about human origins.	I U H	K3 K8	1 4			(C)Evolution (V)Inquiry (V)Insight
12. The student knows the ways in which past geologic events may have influenced the development and distribution of human populations.	I U H	K8	4			
13. The student knows historic and recent contributors to scientific research about human origins (e.g., Darwin, Andrews, Dart, Leakey).	I U H	K4	1 4	1		(C)Research (V)Respect for others

6. Earth and space sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.2 Evolution and variation (Cont.)						
14. The student knows ways in which current research has broadened and altered theories about the origins, distribution, and development of human species.	I U H	K8	1 3 4			(C)Research (C)Theory (V)Inquiry (V)Inter-relatedness (V)Openness

6. Earth and space science
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.3 Fossils						
1. The student knows that the bodies of organisms buried in sediment may be preserved as fossils.	P I	G2 K7	4			
2. The student knows the processes and conditions under which fossils were formed.	P I	K3 K7	4			
3. The student knows the ways in which different kinds of fossils were formed (e.g., animals preserved in ice, mineralized fossils, molds and casts, borings of worms and mollusks, gastroliths, coprolites, artifacts).	P I U	K5 K7	4			
4. The student knows the meaning of the terms associated with fossils (e.g., index fossil, extinct, adaptation, prehistoric, paleontology).	P I U	K1 K2	3 4			
5. The student knows ways in which fossils are used by humans (e.g., research, economic use of fossil fuels).	I U H	K7	4			
6. The student knows that the study of fossils contributes to our knowledge of changes that have taken place on earth.	I U H	K2 K7	4		6.3.4.4	
7. The student knows ways of determining past climatic conditions from the kinds of fossils found (e.g., large ferns--tropical climate).	I U H	K2	3 4		6.3.4.4	

6. Earth and space sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.3 Fossils (Cont.)						
8. The student knows ways in which fossils are used to tell which layer of sedimentary rock was made (laid down) first (superposition).	I U H	K2 K7	3 4		6.3.4.4	
9. The student knows the methods used in fossil extraction.	P I U H	K2 K7	3 4	1	6.3.4.4	(V)Inquiry (V)Utility (V)Resourcefulness
10. The student knows laboratory methods of treating fossils for preservation and exhibition.	P I U H	K2 K7	3 4	1	6.3.4.4 2.2.2	(V)Utility (V)Inquiry (V)Resourcefulness
11. The student is able to use conventional procedures for extracting or preserving fossils.	U H	P35	1 2 3 7			(V)Inquiry (V)Utility (V)Resourcefulness (V)Participation (V)Curiosity
12. The student knows criteria by which fossils are classified (e.g., time period, location, kind of organism).	U H	K9	3 4			
13. The student knows ways in which fossils are named (e.g., taxonomic classification by structure).	U H	K2	3 4		3.2.3.3	
14. The student is able to use conventional systems for classifying or identifying fossils.	U H	P31 P33	1 2 3			

6. Earth and space science
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.3 Fossils (Cont.)						
15. The student knows that an invertebrate fossil is a fossil of an animal without a backbone.	I U H	K1 K2	3 4		3.2.3.2	
16. The student knows that invertebrates preceded vertebrates in geologic time: invertebrate fossils are found in older rocks, strata.	I U H	G1 K4	4			
17. The student is able to identify invertebrate fossils of different types (e.g., trilobites, gastropods).	I U H	P33	1 2 3 7			(V)Accuracy (V)Resourcefulness (V)Inquiry (V)Curiosity
18. The student knows the importance of invertebrate fossils in dating and correlating geologic time.	I U H	K7	1 3 4			(V)Inquiry (V)Accuracy (V)Organization
19. The student knows that a vertebrate fossil is a fossil of an animal having a backbone.	I U H	K1 K2	3 4			
20. The student is able to identify vertebrate fossils.	I U H	P33	1 2 3			(V)Inquiry (V)Accuracy (V)Resourcefulness

6. Earth and space sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.3 Fossils (Cont.)						
21. The student knows the evolution of vertebrates from early to current forms.	I U H	K4	1 4			(V)Inquiry (V)Perspective (V)Life
22. The student knows the development of specific vertebrates (e.g., elephant, horse, dinosaur).	I U H	K4 K5	4			
23. The student knows that plants evolved from simple to complex forms.	I U H	G1 K4	4		6.3.4.2	
24. The student knows the evolution of specified plant forms (e.g., ferns, conifers, deciduous trees).	I U H	K4	4			
25. The student is able to identify a plant fossil.	I U H	P33	1 2 3 7			(V)Inquiry (V)Accuracy (V)Resourcefulness
26. The student knows that coal and oil are called fossil fuels because they are derived from fossil plant material.	I U H	K2 K5	4			
27. The student knows that fossilized plant materials produce fossil fuels (e.g., coal, oil).	I U H	K7	4			

6. Earth and space sciences
6.3 Geology
6.3.4 Earth's history (historical geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.4.4 Methods of dating						
1. The student knows the current dating methods for geologic events (e.g., magnetic reversals, Carbon 14, Potassium-Argon, Uranium).	U H	K2 K7	3 4		6.3.6	(C)Research
2. The student knows that the strata of each geological formation have unique features which can be used to date the strata and their contents.	P I U	K2 K3 K7	3 4			
3. The student knows that in an undisturbed sequence, the oldest rocks are at the bottom and youngest on top.	P I U	K6	4			
4. The student knows that dating and reconstruction of the earth's history are dependent on correlation of rock units from one area to another.	P I U	K2 K7	3 4			
5. The student knows the use of index fossils in dating.	I U H	K2 K7	3 4			

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5 Earth environments (environmental geology)						
1. The student knows the location and use of print and nonprint materials related to environmental geology (e.g., card catalog: "Water-Pollution," "Rivers," "Water Conservation"; SUBJECT GUIDE TO BOOKS IN PRINT: "Air-Pollution," "Soil Science," "Water Polution"; READER'S GUIDE: "Air Pollution-Control," "Soil Conservation," "Water Pollution," "Water Reuse"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Soils," "Watersheds," "Air Pollution"; LEARNING DIRECTORY: "Soil Conservation," "Air," "Water Conservation"; area and building audiovisual catalogs: "Air," "Water Resources Development," "Soil Conservation").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environments (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.1 Soil						
1. The student knows ways in which plant decay, and animal activity make fertile topsoil (e.g., holding water, aerating soil, enriching soil, breaking up rock).	P I U H	K8	4			(C)Ecosystem
2. The student knows that recycling means returning wasted or used materials for further treatment and use.	P I	K1 K2 K4	3 4			(C)Ecology
3. The student knows that conservation means wise use of our natural resources.	P I	K1 K2	3 4			(C)Conservation
4. The student knows important contributors to the concept of conservation of natural resources.	P I U H	K1 K4	1 4	1		(C)Conservation (C)History of science (V)Respect for others
5. The student knows that water and wind are the main forces that erode the soil.	P I	K8	4		6.3.3.3	
6. The student knows examples of the effects of erosive agents at work in his or her community.	P I	K8	4			
7. The student knows natural factors which prevent soil erosion (e.g., plant roots)	P I	K8	4			
8. The student knows human activities which expose soils to erosion (e.g., logging, mining, bulldozing, plowing).	P I U H	K8	4			

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environments (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.1 Soil (Cont.)						
9. The student knows ways of preventing soil erosion (e.g., having an adequate ground cover of plants to hold the soil, planting trees and shrubs as wind breaks and for root development to hold the soil, contour plowing and planting, strip planting, terracing, rotating crops, careful cultivation, avoidance of overgrazing)	P I U H	K7	3 4			
10. The student knows how the nutrient content of the soil is maintained and/or improved (e.g., organic fertilization, rotating crops, growing legumes, leaving land fallow).	P I U H	K8	4			
11. The student knows that the erosion of the soil is related to the natural contour of the land, porosity of the soil, texture of the soil, and hardness of the minerals in the soil.	I U H	K8	4			
12. The student knows the factors considered in determining land use capabilities (e.g., wetness, salinity or alkalinity, climate, slope, erosion, overflow, soil permeability, water supplying capacity, depth, nutrient supplying capacity, and texture).	U H	K9	3 4			(C)Land use

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environments (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.1 Soil (Cont.)						
13. The student knows characteristics of topsoil.	I U H	K3	4			
14. The student knows that different soils dry out at different rates.	P I	K5	4			
15. The student knows ways in which the amount of moisture in the soil is related to the rate of decay and formation of humus.	I U H	K8	4			
16. The student knows factors affecting water in soil (e.g., amount of precipitation, type of soil, processes of evaporation, capillary action, and transpiration from plants).	I U H	K8	4			(C)Ecosystem
17. The student knows that the type of soil in any region is dependent upon the interrelationship of parent material, topography or relief, time, climate, and biological activity.	U H	K8	4			(C)Ecosystem
18. The student knows the kinds of plants that grow in soil of certain pH (acidity-alkalinity).	I U H	K6	4			
19. The student knows that topsoil is needed for growing the plants necessary for the survival of humans and other animals.	P I	K8	4			(C)Survival (C)Ecosystem

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environment (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.1 Soil (Cont.)						
20. The student knows ways in which misuse of soil has affected an area.	P I	K8	1 4			(C)Conservation (V)Problem solving (V)Social sensitivity
21. The student knows how ignorance of environmental geology has had adverse effects in his or her region (e.g., landslides due to cutting "toe" from hill).	I U H	K8	1 4			(C)Conservation (V)Inquiry (V)Knowledge

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environment (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.2 Water						
1. The student knows the ways in which watershed regions are damaged (e.g., overgrazing, removal of ground cover, strip and open pit mining).	P I U H	K8	1 4			(V) Social concern (V) Survival
2. The student knows methods of flood control (e.g., protecting dike or levee; channel deepening, straightening and widening; spillways and floodways; retarding basins; dams or reservoirs; ground covers, reforestation).	P I U H	K7	1 4	1		(V) Respect for others (V) Social concern (V) Survival
3. The student knows the chief causes of water pollution (e.g., domestic sewage, industrial wastes, fine particles of soil washed from farms, detergents, insecticides, oil spillage, solid wastes, hot water from atomic reactors).	P I U H	K8	1 4			(V) Social concern (V) Survival
4. The student knows the chief causes of excess nitrogen in the water (e.g., excess fertilization of soils, detergents, excess aeration of water due to dams).	I U H	K8	1 4			(V) Social concern
5. The student knows effects of excess nitrogen in the water (e.g., increased growth of algae and other plants and destruction of fish life).	I U H	K8	1 4			(V) Life (V) Nature

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environment (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.2 Water (Cont.)						
6. The student knows that there is a direct relationship between the amount of oxygen in the water and the amount of animal life present.	I U H	K8	4			
7. The student knows ways of determining the oxygen content, acidity (pH), and living organisms present in the water.	U H	K2 K7	1 3 4	1		(V)Accuracy (V)Problem solving (V)Nature
8. The student knows some methods being used in his or her area to prevent water pollution and to recycle water.	P I U H	K7	1 4	1		(C)Conservation (V)Problem solving (V)Respect for others (V)Social concern
9. The student knows the conditions under which irrigation is used.	P I	K8	1 4	1		(V)Problem solving (V)Productivity (V)Progress
10. The student knows ways in which irrigation systems affect land use and agricultural productivity.	I U H	K8	1 4	1		(V)Social concern (V)Interdependence (V)Productivity
11. The student knows historic and modern irrigation systems (e.g., sources, equipment, structures, principles upon which systems are based).	I U H	K4 K5	1 4	1		(C)History of science (C)Technology (C)Land use (V)Problem solving (V)Progress (V)Insight
12. The student knows effects of modern irrigation systems (dams, aquaducts, etc.) on natural land farms.	I U H	K8	1 4			(C)Natural environment (V)Nature

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environment (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.2 Water (Cont.)						
13. The student knows values in conflict over modern irrigation systems, land reclamation projects, etc., (e.g., economic needs of a region vs. preservation of natural environment).	I U H	K9	1 4		Appendix I	(V)Social sensitivity (V)Problem solving

6. Earth and space sciences
6.3 Geology
6.3.5 Earth environment (environmental geology)

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.5.3 Air						
1. The student knows examples of air pollution in his or her area and its effects.	P I U H	K8	1 4			(C)Pollution (V)Survival (V)Social sensitivity (V)Social concern
2. The student knows the chief causes of air pollution (e.g., automobile exhaust, domestic and industrial burning of fossil fuels, field burning, industrial wastes, smoking, radioactive wastes).	P I U H	K8	1 4			(C)Pollution (V)Survival (V)Social sensitivity (V)Social concern
3. The student knows the ways in which air is tested to determine the amount of pollutants present.	U H	K2	1 3 4	1		(C)Pollution (V)Problem solving (V)Accuracy
4. The student knows that the occurrence of a temperature inversion results in increased potential for air pollution.	I U H	K8	4			(C)Pollution

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.6 Tools of geologists						
1. The student knows the location and use of print and nonprint materials related to tools of geologists (e.g., card catalog: "Geology-Maps," "Scientific Apparatus and Instruments," "Radiocarbon Dating"; SUBJECT GUIDE TO BOOKS IN PRINT: "Aerial Photography and Geology," "Geological Modeling," "Geology-Maps"; READER'S GUIDE: "Radioactive Dating," "Geological Models," "Seismology"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Geological Surveys," "Geological Models," "Prospecting-Geochemical Methods"; LEARNING DIRECTORY: "Geologic Map," "Geology, Rock Classification"; area and building audiovisual catalogs: "Geology," "Rocks," "Volcanoes," "Fossils").	P I U H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows how maps are used in the study of geology (e.g., stereo maps, topographical maps, plastic relief maps, geological maps, and contour maps).	P I U H	K2 K7	4		2.2.4	(C)Data representation (C)Mapping
3. The student is able to interpret relief maps accurately.	I U H	P41	1 2 3		7.2	(V)Accuracy

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.6 Tools of geologists (Cont.)						
4. The student is able to construct a model from a contour map.	I U H	P76	1 2 3 8		2.2.4	(V)Resourcefulness (V)Creativity
5. The student is able to locate, measure, and draw land features.	P I U H	P36 P65 P67 P76	1 2 3 8			(V)Resourcefulness (V)Accuracy (V)Creativity
6. The student is able to create models from actual landscapes.	I U H	P67 P76	1 2 3 8		2.2.4	(V)Creativity
7. The student knows that model building requires attention to scale, proportion, point of view, and distance.	I U H	K9	3 4		2.2.4	
8. The student knows ways in which distance can be measured directly and indirectly (e.g., ruler, tape, triangulation).	I U H	K2 K7	3 4		2.2.1.1	
9. The student knows ways of using fixed landmarks as reference points for identifying locations.	I U H	K2 K6 K7	3 4		2.2.1.1	(C)Frame of reference
10. The student is able to make a geologic map.	I U H	P66	1 2 3 8		2.2.4	(V)Resourcefulness (V)Creativity

6. Earth and space sciences
6.3 Geology

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.6 Tools of geologists (Cont.)						
11. The student knows instruments and procedures used in geological field work (e.g., pick, chisel, level, lens, sample log, mineral identification kit).	I U H	K2	3 4	3		(C)Research (C)Technology
12. The student knows instruments and procedures used by geologists for laboratory analysis and experimentation.	I U H	K2	3 4	3		(C)Research (C)Technology
13. The student knows electronic devices used by geologists for collecting, interpreting, or storing data (e.g., stereoscope, seismograph computer).	I U H	K2	3 4	 3		 (C)Research (C)Technology
14. The student is able to select and use effectively geological tools and procedures appropriate to his or her purpose (e.g., inquiry, private collecting, personal problem solving).	I U H	P33 P65	1 2 3 5			(V)Resourcefulness (V)Utility (V)Inquiry (V)Curiosity

6. Earth and space sciences
6.3 Geology
6.3.7 Applications of geologic science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.7.1 Related sciences						
1. The student knows ways in which geologic discoveries, data, procedures, and theories are used in other sciences.	P I U H	G2 K2 K7	1 4 6	1		(C)Research (V)Inquiry (V)Interdependence
2. The student knows that procedures, instruments, and data from historical geology are used by many sciences in developing or validating theories about prehistoric conditions or events (e.g., archaeology, anthropology, astronomy, biology, physics, oceanography, history).	I U H	K2 K7	1 4 6	3	8.2	(C)Research (V)Inquiry (V)Interdependence
3. The student knows that procedures, instruments, data, etc., from physical geology are used by many sciences in developing or validating theories or models (e.g., ecology, systems sciences, physics, astronomy, geography, meteorology).	I U H	K2 K7	1 4 6	3	8.2	(C)Research (V)Inquiry (V)Interdependence
4. The student knows reasons why scientists engaged in research for future planning need geologic data.	I U H	K2 K8 K9	1 4 6	1 3	8.2.5	(C)Research (V)Inquiry (V)Interdependence

6. Earth and space sciences
6.3 Geology
6.3.7 Applications of geologic science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.3.7.2 Economic uses						
1. The student knows ways in which geologic information is used in locating, developing, or allocating natural resources.	P I U H	K7	4 6	1		(C)Natural resources
2. The student knows that subdisciplines of economic geology include mining geology, petroleum geology, engineering geology, etc.	I U H	K2 K5	4 6	3	8.2	
3. The student knows ways in which geologic information is used to develop commercial and industrial technology.	P I U H	K7	4 6	1		(C)Technology
4. The student knows ways in which geologic information is used in agriculture.	P I U H	K7	4 6	1		(C)Agriculture
5. The student knows ways in which geologic information is used in planning and building homesites, industrial plants, cities, bridges, etc.	P I U H	K7	4 6	1		(C)Technology
6. The student knows societal or scientific issues related to the economic uses of geologic information.	P I U H	K3	1 4 5 6	1	Appendix I	(V)Problem solving (V)Social concern

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.1 History of oceanography						
1. The student knows the location and use of print and nonprint materials related to history of oceanography (e.g., card catalog: "Oceanography"; SUBJECT GUIDE TO BOOKS IN PRINT: "Oceanography"; READER'S GUIDE: "Oceanography"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Ocean"; LEARNING DIRECTORY: "Oceanography, History"; area and building audiovisual catalogs: "Oceanography").	P I U H	K6	3		2.1.1.2	(C)Resources (V)Inquiry
2. The student knows that oceanography includes the study of: topography of ocean basins, composition of sea water, shore features, characteristics of currents and tides, characteristics of waves and wave action, temperature, and life forms present.	I U H	K2 K5	3 4	3	8.2.4	
3. The student knows that oceanography uses information from many other disciplines (e.g., geology, chemistry, physics, biology, meteorology, astronomy, mathematics).	I U H	K2 K7	3 4	1		
4. The student knows historic and current contributions of oceanographers and institutions to the field of oceanographic research.	I U H	K4	1 4	1		(C)History of science (C)Research (V)Respect for others (V)Inquiry

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.1 History of oceanography (Cont.)						
5. The student knows historic and current developments in the technology of oceanographic research.	I U H	K4	1 4	1		(C)History of science (C)Technology (C)Research (V)Inquiry (V)Utility
6. The student knows ways in which improved technology has changed the science of oceanography.	I U H	K4 K8	1 4	1		(C)Technology (C)History of science (V)Inquiry

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.2 The ocean basins (see also 6.3.2.3 Surface features)						
1. The student knows the location and use of print and nonprint materials related to ocean basins (e.g., card catalog: "Ocean," "Oceanography"; SUBJECT GUIDE TO BOOKS IN PRINT: "Ocean Bottom," "Islands," "Coral Reefs and Islands"; READER'S GUIDE: "Ocean Bottom", "Ocean"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Ocean Bottom," "Ocean," "Islands"; LEARNING DIRECTORY: "Continental Shelf," "Ocean, Topography," "Ocean Floor"; area and building audiovisual catalogs: "Oceanography," "Physical Geography").	I U H	K6	3			(C)Resources (V)Inquiry
2. The student know additional sources related to ocean basins (e.g., National Geographic topographic map of Pacific Ocean, Indian Ocean, Atlantic Ocean, relief models).	I U H	K6	3			(C)Resources (V)Inquiry
3. The student knows that most of the earth's surface is covered by water (e.g., 71%).	P I	K3	4			
4. The student knows size relationships between land and ocean bottom topography.	P I	K10	4			

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.2 The ocean basins (Cont.)						
5. The student knows that ocean basins are defined as the floor of the ocean.	P I	K1 K2	3 4			
6. The student knows that the ocean floor has topographical features similar to those on land (e.g., mountains, mountain ranges, plains, trenches, troughs, ridges).	P I	K3	4			
7. The student knows that the ocean basins are constantly changing features of the earth's crust.	P I	K3	4			
8. The student knows that the present ocean basins are relatively young.	P I	K3	4			
9. The student knows that the crust of the earth is only about one-fifth as thick in the ocean basins as it is on the continents.	P I	K3	4			
10. The student knows that the rocks of the ocean basins are generally distinctly different from rocks on the continents.	P I	K3 K5	4		6.3.2.5	
11. The student knows names and characteristics of major structures of ocean basins (e.g., rises, abyssal plains, trenches, island arcs, sea mountains, abyssal hills, fracture zones, volcanic centers).	I U H	K1 K3	3 4			

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.2 The ocean basins (Cont.)						
12. The student knows that eroded sediments from land are distributed unevenly over the ocean basins.	I U H	K6	4		6.3.3.3	
13. The student knows relationships between currents, sediments and structures of ocean basins.	I U H	K8	4			
14. The student knows how eroded material has modified the shape of continental margins.	I U H	K6 K7 K8	4			
15. The student knows that the beach is dynamic (in a constantly changing state).	I U H	G2 K3	4		6.3.3 6.1.5	
16. The student knows that the continental margin is the result of dynamic interplay of natural forces.	I U H	G2 K8	4		6.3.3 6.1.5	
17. The student knows topographic features of continental margins (e.g., shore, continental shelf, continental slope, shelf break, continental rise, submarine canyons).	I U H	K5 K6	3 4			
18. The student is able to identify topographic features of continental margins in his own area.	I U H	P31 P45	2 3			
19. The student knows topographic zones found between the continental margin and the deep ocean basins (e.g., littoral, neritic, bathyl, abyssal).	I U H	K5 K6	3 4			

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.2 The ocean basins (Cont.)						
20. The student knows that parts of the oceans overlying the continental margins (shelf, slope, rise) are of the greatest importance to man (e.g., food sources, shipping, pollution).	I U H	G2 K6 K7	4			
21. The student is able to use accurately conventional terms for ocean bottom features, topographic zones, etc.	U H	P31 P41 P66	1 2 3			(V)Accuracy (V)Resourcefulness (V)Utility

6. Earth and space sciences
6.4 Oceanography
6.4.3 The ocean waters

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.3.1 Composition and properties of seawater						
1. The student knows that water is a solvent.	P I U H	K3	4		4.3	
2. The student knows that seawater has different properties from fresh water because of the material dissolved in it.	P I U H	K5 K8	4			
3. The student knows common characteristics which distinguish seawater from fresh water (e.g., seawater tastes salty; things float better in it).	P I	K3 K5	4			
4. The student knows that most matter dissolved in the sea has been eroded from land areas, dissolved in streams and rivers, and carried by them to the sea.	P I U H	K4 K6	4			
5. The student knows reasons why chemicals become concentrated in seawater.	P I U H	K8	4			
6. The student knows the general chemical composition of seawater (e.g., names of chemicals, approximate proportions).	U H	K3	4			
7. The student knows names and properties of some of the chemicals found most abundantly in the oceans (e.g., NaCl, $MgCl_2$, $MgSO_4$, K_2SO_4).	U H	K1 K3	4			

6. Earth and space sciences
6.4 Oceanography
6.4.3 The ocean waters

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.3.1 Composition and properties of seawater (Cont.)						
8. The student knows factors which produce variations in salinity of seawater.	U H	K8	4			
9. The student knows effects of salinity on the physical properties of seawater.	U H	K8	4			
10. The student knows effects of salinity on living things in the ocean.	U H	K8	4		6.4.6 3.4.1	(C)Environment
11. The student knows ways in which various sea organisms depend on phosphate, carbonate, nitrate, and oxygen in seawater.	U H	K8	4		6.4.6 3.4.1	(C)Environment
12. The student knows the carbonate cycle.	U H	K4	4			
13. The student knows the nitrogen cycle.	U H	K4	4			
14. The student knows that the density of seawater varies with its salinity and temperature.	U H	K3 K8	4			
15. The student knows ways of determining the density of seawater (e.g., measurement of chlorine content).	U H	K2	3 4			(C)Tools (V)Utility (V)Resourcefulness
16. The student knows other physical properties of seawater which vary with salinity and temperature (e.g., speed and direction of currents).	U H	K3	4			

6. Earth and space sciences
6.4 Oceanography
6.4.3 The ocean waters

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.3.2 Ocean layers and zones						
1. The student knows ways in which layering of ocean waters relates to varying densities.	I U H	K8 K10	4			
2. The student knows dynamics affecting density and layering of seawater.	I U H	K8	4			
3. The student knows names and characteristics of major layers of ocean water (e.g., bottom water, deep water, intermediate water).	I U H	K5	4			
4. The student knows approximate depths of major ocean layers.	I U H	K6	4			
5. The student knows life forms characteristic of various ocean layers.	I U H	K3 K5	4		6.4.6.1 3.4.1	
6. The student knows that ocean zones are classified by amounts of sunlight which reach them.	U H	K2 K5	3 4			
7. The student knows names and characteristics of major oceanic zones (e.g., euphotic, aphotic).	U H	K5	4			
8. The student knows life forms characteristic of major oceanic zones.	U H	K3 K5	4		6.4.6.1 3.4.1	

6. Earth and space sciences
6.4 Oceanography
6.4.4 Ocean movements

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.4.1 Circulation and currents						
1. The student knows that ocean currents are movements of large masses of water.	P I U	K2	3 4			
2. The student knows causes of ocean currents (e.g., wind, rotation of earth, land contours; differences in density of seawater).	I U H	K8	4			
3. The student knows names and characteristics of various kinds of ocean currents (e.g., surface, density, turbidity).	I U H	K5	4			
4. The student knows names and courses of major ocean currents (e.g., Japanese, Atlantic).	I U H	K1 K4 K6	4			
5. The student knows effects of major ocean currents on the climate and topography of adjacent land masses.	I U H	K6 K8	4		6.2.7	
6. The student knows ways in which ocean currents affect climate by their transportation of heat energy.	I U H	K7 K8	4		5.9	(C)Energy
7. The student knows that bodies of water heat and cool slowly.	P I U	K3	4		5.9	

6. Earth and space sciences
6.4 Oceanography
6.4.4 Ocean movements

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.4.1 Circulation and currents (Cont.)						
8. The student knows oceans (and other large bodies of water) have a steadying or moderating influence on the temperature of our planet and upon climate in general.	P I U H	K8	4			(C)Regulation
9. The student knows that changes in ocean circulation have a direct effect on the land.	I U H	K8	4		3.5.1.3	
10. The student knows ways in which changes in an ocean's circulation affect humans.	I U H	K8	4		3.5.1.3	
11. The student knows names and characteristics of ocean circulatory processes (e.g., upwelling, convergence, divergence, mass transport).	I U H	K5 K7	4			
12. The student knows the role of ocean circulation in marine ecosystems (e.g., transport of nutrients through upwelling).	I U H	K4 K7	4			(C)Ecosystem
13. The student knows that life in the ocean is most plentiful where deep ocean currents meet each other and force water from the sea bottom up towards the surface, thus replenishing nutrients for simple life forms on which others feed.	I U H	K3 K6	4		6.4.6.1 3.4.3	(C)Ecosystem

6. Earth and space sciences
6.4 Oceanography
6.4.4 Ocean movements

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.4.2 Tides						
1. The student knows the types of tidal cycles which occur at different places (e.g., mixed, diurnal).	I U H	K5	4			
2. The student knows that a diurnal tide is a daily tide with equal highs and lows.	I U H	K1 K2	3 4			
3. The student knows that a mixed tide consists of two unequal highs and two unequal lows each day.	I U H	K1 K2	3 4			
4. The student knows the forces which are responsible for tides on the earth (e.g., lunar, solar, centrifugal, tractive).	I U H	K8	4			
5. The student knows that the moon's tide producing effect varies depending upon whether it is in the perigee or apogee of its eliptical orbit.	I U H	K6 K8	4		5.4 6.1.3.4 6.1.5	
6. The student knows that tide levels (lower neap tide and higher spring tide) are related to the different positions of the sun and moon in relation to the earth.	I U H	K6 K8	4			

6. Earth and space sciences
6.4 Oceanography
6.4.4 Ocean movements

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.4.2 Tides (Cont.)						
7. The student knows how the knowledge of periodicity of tides is presently used by man in regulating his commercial, recreational, and scientific endeavors relating to the oceans (e.g., fishing, surfing, studying intertidal life zones).	I U H	K7	4	1		
8. The student knows how the energy of incoming and outgoing tides is being used to generate electricity.	I U H	K7	4	1		(C)Energy (C)Technology
9. The student knows terminology referring to tides (spring tide, neap tide, flood, ebb).	I U H	K1	3 4			
10. The student is able to read tide tables.	I U H	P41	2 3			

6. Earth and space sciences
6.4 Oceanography
6.4.4 Ocean movements

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.4.3 Waves						
1. The student knows that the main cause of ocean waves is the wind.	P I U H	G2 K8	4			
2. The student knows factors that affect wave height (e.g., wind speed, wind direction, the fetch--distance of open water over which the wind blows, and wave length).	I U H	K8	4			
3. The student knows factors affecting the speed of waves (e.g., depth of water, wave length).	I U H	K8	4			
4. The student knows the changes in waves as they pass from deep to shallow water.	P I U H	K4 K6	4			
5. The student knows that an ocean wave breaks when it enters shallow water where the depth is about one seventh of the wave length.	I U H	G2 K7	4			
6. The student knows shoreline characteristics that affect wave magnitude and rhythm (e.g., slope of bottom, depth of channel, width of entrance).	I U H	K8	4		6.4.5.1	
7. The student is able to measure the speed, period, and wave lengths of water waves.	U H	P35 P45	2 3			

6. Earth and space sciences
6.4 Oceanography
6.4.4 Ocean movements

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.4.3 Waves (Cont.)						
8. The student knows different types of waves and their characteristics (e.g., ripples, chop, seas, swells, tsunamis).	I U H	K5	3 4			
9. The student knows the meaning of terms having to do with waves (e.g., crest, trough, height, wave length, period, whitecap, swell, breaker, undertow, rip current, long shore current, refraction).	I U H	K1 K2	3 4			
10. The student knows that tidal waves consist of crests (high tide) and troughs (low tide) which move throughout ocean basins.	I U H	K1 K2	3 4			
11. The student knows that tidal waves (tsunami) can result from suboceanic faulting.	I U H	K8	4		6.3.3.2	

6. Earth and space sciences
6.4 Oceanography
6.4.5 Shorelines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.5.1 Types of shorelines						
1. The student knows the characteristics of primary and secondary coastlines.	I U H	K1 K5	3 4			
2. The student knows shoreline land forms made by deposition (e.g., bay, lagoon, bay-mouth bar, offshore bar, spit, tombolo, land tied island, barrier beach, sandy beach, shingle beach).	I U H	K5	3 4		6.3.3.3	
3. The student knows shoreline land forms made by erosion (e.g., headland, bay, wave cut cliff, wave cut terrace, sea cave, sea arch, sea cliff, stack).	I U H	K5	3 4		6.3.3.3	
4. The student is able to identify primary and secondary coastlines (e.g., from maps, in the field).	I U H	P31 P41 P45	2 3			
5. The student knows structural characteristics of islands, reefs, swamps, deltas, estuaries, and tide flats.	I U H	K3 K5	3 4			

6. Earth and space sciences
6.4 Oceanography
6.4.5 Shorelines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.5.2 Shoreline processes (see also 6.3.3.3 Weathering, erosion, deposition)						
1. The student knows the erosional and depositional effect of waves upon shorelines.	P I U H	K8	4			
2. The student knows the meaning of the term longshore transport.	I U H	K1 K2	3 4			
3. The student knows the roles of wave action and longshore transport in the characteristic development of coastal landforms.	I U H	K7	4			
4. The student knows the depositional features of beaches (e.g., berms, foreshore), and their seasonal changes.	I U H	K5	4			
5. The student knows the causes and effects of shoreline erosion and deposition.	P I U H	K8	4			
6. The student is able to identify shoreline forms caused by erosion such as headlands, cliffs.	P I U H	P45	2		6.4.5.1	
7. The student is able to identify shoreline forms caused by deposition (e.g., spits, lagoons, bays).	P I U H	P45	2		6.4.5.1	

6. Earth and space sciences
6.4 Oceanography
6.4.5 Shorelines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.5.2 Shoreline processes (Cont.)						
8. The student knows ways in which changes in ocean level have affected humans.	P I U H	K8	4		3.5.3 6.3.5.2	
9. The student knows that shorelines are constantly changing from the effects of waves, tides, currents, glacial fluctuations, and climate.	P I U H	G2 K7 K8	4			
10. The student is able to predict changes in shorelines which will be brought about by changes in wave energy and direction, depth of water, and sediment supply.	U H	P51	2 3			(V)Prediction
11. The student knows changes in shoreline processes brought about by construction of jetties, breakwaters, etc.	P I U H	K7 K8	4			(V)Environment

6. Earth and space sciences
6.4 Oceanography
6.4.5 Shorelines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.5.3 Estuaries and bays						
1. The student knows that an estuary is a semi-enclosed body of sea water having free circulation with the open ocean, in which there is a measurable dilution of sea water by fresh water (usually supplied by streams).	P I U H	K1 K2 K3	3 4			
2. The student knows names and characteristics of the four types of estuaries (i.e., drowned river valleys, fjords, bar-built, and tectonics).	I U H	K5	3 4			
3. The student knows that estuaries are characterized by the type of circulation present, determined by the relative influence of tidal influx of salt water and river input of fresh water.	U H	K2	3 4			
4. The student knows that sedimentation, distribution of living things, flushing and distribution of nutrients depend upon the type of estuarial circulation pattern.	U H	K8	4			
5. The student knows reasons why estuaries are commonly considered the most important link between the land and the sea.	I U H	K8	4			(V)Critical judgment

6. Earth and space sciences
6.4 Oceanography
6.4.5 Shorelines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.5.3 Estuaries and bays (Cont.)						
6. The student knows that the majority of the world's population is concentrated in coastline areas (e.g., near estuaries).	P I U H	K3 K6	4		6.4.6.4	
7. The student knows that man's activities in estuaries include shipping, military, food-getting, recreation, industrial plants, and power plants.	P I U H	K7	4		6.4.6.4	
8. The student knows the direct effects of tributary streams upon estuaries (e.g., quality of water, circulation, sedimentation).	I U H	K8	4			
9. The student knows reasons why estuaries are of primary importance to marine life (e.g., they are breeding and nursery grounds).	P I U H	K8	4		3.4.3 6.4.6.3	(C)Environment (C)Ecosystem (V)Nature
10. The student knows the importance of estuaries to birds and land animals.	P I U H	K8	4			(C)Environment (C)Ecosystem (V)Nature
11. The student knows that misuse of estuaries can result in profound changes in circulation, sedimentation, quality of water and marine life.	P I U H	K8	4		6.4.6.4	(V)Nature (V)Quality of life

6. Earth and space sciences
6.4 Oceanography
6.4.5 Shorelines

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.5.3 Estuaries and bays (Cont.)						
12. The student knows that bays and lagoons are semi-enclosed bodies of water without measurable dilution of salt water by fresh water.	P I U H	K1 K2 K3	3 4			
13. The student is able to distinguish between estuaries and bays or lagoons.	P I U H	P45	2 3			

6. Earth and space sciences
6.4. Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.1 Distribution						
1. The student knows that some life exists at all depths of the ocean.	P I U H	K3 K6	4			
2. The student knows that the majority of sea life exists over the continental shelf and in areas of upwelling, with other areas being almost devoid of life.	P I U H	K3 K6	4			
3. The student knows that oceanographers have defined life zones in the sea, based on amounts of sunlight received.	I U H	K5	4	1	6.4.3.2	
4. The student knows names and characteristics of major life zones.	I U H	K5	3 4		6.4.3.2	
5. The student knows that most sea life is concentrated in three main zones: the sunlit surface waters, shallow bottoms near shores, and just beneath the surface of open sea waters.	P I U H	K3 K6	4		6.4.3.2	
6. The student knows physical factors which affect the distribution of life in the oceans (e.g., sunlight, temperature, turbidity, substrate, availability of oxygen and other nutrients).	I U H	K8	4		3.4.1	(C)Ecosystem

6. Earth and space sciences
6.4 Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.1 Distribution (Cont.)						
7. The student knows interspecific reactions (relationships between organisms) which affect the distribution of life in the oceans (e.g., predation, commensalism, parasitism).	I U H	K8	3 4		3.4.2	(C)Ecosystem (V)Life (V)Interdependence
8. The student knows that some marine organisms are adapted to life in a particular area or zone, and others are more mobile.	P I U	G2 K3 K6	4		3.4	(C)Adaptation (C)Environment
9. The student knows forms characteristic of various ocean zones, layers, and geographic areas.	P I U H	K5 K6	4		3.4.1	(C)Environment
10. The student knows approximate proportional distribution of major categories of marine organisms in a defined region (e.g., a particular body of water; earth).	H	K3 K5	4			

6. Earth and space sciences
6.4 Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.2 Marine organisms						
1. The student knows kinds of simple organisms that live in seawater.	I U H	K5	5		3.2.3 3.4.4	(V)Diversi
2. The student knows that marine plants are the primary source of all food in the sea.	P I U H	G2 K3	4		3.4.3 6.4.6.4	(C)Ecosystem
3. The student knows that marine plant growth is regulated by availability of nutrients and sunlight.	P I U H	G2 K8	4		3.4.3 6.4.6.4	(C)Ecosystem (C)Regulation
4. The student knows that most marine plants are types of plankton.	P I U H	G2 K5	4			
5. The student knows forms of plant life characteristic of various marine habitats (e.g., kelp near shorelines).	P I U H	K3 K5	4		3.4.1	(C)Environment (C)Adaptation (V)Diversity
6. The student knows that the term Pelagic refers to the animals that live in the open waters of the ocean.	I U H	K1 K5 K6	3 4		3.2.3.2	
7. The student knows that the term Benthos refers to animals that live anywhere on the ocean floor.	I U H	K1 K5 K6	3 4		3.2.3.2	
8. The student knows the variety of animal life in the ocean.	P I U H	G2 K5	4			(V)Diversity

6. Earth and space sciences
6.4 Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.2 Marine organisms (Cont.)						
9. The student knows types of adaptation characteristic of animals living in various marine habitats.	P I U H	K5 K6	4			(C)Adaptations
10. The student knows that humans can use equipment to adjust to a marine environment (e.g., diving bell, scuba gear).	P I U H	G2 K7	4	1		(C)Technology
11. The student knows that some animals living in the ocean take oxygen from the water, and others must surface to get oxygen from air.	P I	G2 K7	4		3.2.3 3.4.1	(C)Adaptation
12. The student knows that some animals live in the ocean and on land (e.g., amphibians, mammals such as walrus, seal).	P I	G2 K6	4		3.2.3 3.4.1	
13. The student knows kinds of birds that live at sea.	P I	K5	4		3.2.3 3.4.1	
14. The student knows kinds of fish found in various ocean areas.	P I	K5	4			

6. Earth and space sciences
6.4 Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.3 Marine ecosystems and processes (see also 3.4.3 Ecosystem)						
1. The student knows ways in which various marine organisms interact with one another and with their environments.	P I U H	K7	4			(C)Ecosystem (V)Life (V)Nature (V)Interdependence
2. The student knows elements and processes of the food web in the sea (e.g., plankton as basis).	P I U H	K3 K4	4			(V)Life (V)Nature
3. The student knows meanings of terms used to identify processes and effects of marine food webs (e.g., predation; regulation).	I U H	K1 K2	3 4			
4. The student knows basic factors or elements of various marine ecosystems.	I U H	K5	4			(C)Ecosystem
5. The student is able to use accurately terms which identify factors, interactions, and types of marine ecosystems.	I U H	P31 P41 P66	2 3			(V)Utility (V)Accuracy
6. The student knows natural cycles and systems in which oceans and ocean life are components (e.g., water cycle; nitrogen cycle).	I U H	K4 K7	4			
7. The student knows ways in which marine food webs are related to land food webs.	I U H	K8 K10	4			(C)Ecosystem (V)Life (V)Interdependence

6. Earth and space sciences
6.4 Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.4 Effects of human activities (see also 3.5 Human influence on natural systems)						
1. The student knows general categories of human activities which affect ocean life (e.g., agriculture, industry, commerce, warfare, recreation, construction, waste disposal, mining).	P I U H	K5 K8	4			(V)Life (V)Insight
2. The student knows ways in which humans alter the structure of ocean basins, shorelines, etc. (e.g., dredging, building jetties).	P I U H	K7 K8	4			(V)Nature (V)Insight
3. The student knows ways in which humans use oceans or marine landforms as natural resources (e.g., fishing, offshore mining, decalinization, power source).	P I U H	K7	4			(C)Natural resources (V)Nature (V)Insight
4. The student knows effects on marine organisms of various changes in their physical environments.	P I U H	K8	4			(C)Environment (C)Ecosystem (V)Nature (V)Interdependence
5. The student knows ways in which various kinds of pollution affect marine life (e.g., oil spills, concentration of insecticides).	P I U H	K7 K8	4			(C)Pollution (V)Life
6. The student knows ways in which technological experimentation may affect marine life (e.g., bomb testing).	P I U H	K7 K8	4			(C)Technology (V)Life

6. Earth and space sciences
6.4 Oceanography
6.4.6 Life in the oceans

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.6.4 Effects of human activities (cont.)						
7. The student knows ways in which overuse or overconsumption of ocean resources affect the natural regulation of marine ecosystems (e.g., uncontrolled fishing, whaling, fur trade).	P I U H	K7 K8	4			(C)Regulation (C)Ecosystem (C)Natural resources (V)Nature
8. The student knows threats to human survival presented by the depletion of marine resources or the disruption of natural marine systems.	P I U H	K3	4 5			(C)Conservation (C)Pollution (V)Survival
9. The student knows ways in which various governments, organizations, etc., have attempted to control or regulate human activities which threaten marine life.	P I U H	K7	4			(C)Conservation
10. The student knows current issues related to use or conservation of marine resources, pollution of marine life, etc.	P I U H	K3 K9	4		Appendix I	(C)Conservation (C)Pollution
11. The student is able to clarify or analyze issues related to human influences on marine life.	I U H	P43 P63	2 5		1.1.3.2 2.1.5	(V)Problem solving (V)Nature

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.7 Tools of oceanography						
1. The student knows the location and use of print and nonprint materials related to tools of oceanography (e.g., card catalog: "Oceanography-Research," "Bathyscaphe," "Manned Undersea Research Stations"; SUBJECT GUIDE TO BOOKS IN PRINT: "Oceanographic Instruments," "Oceanographic Research," "Sounding and Soundings," "Underwater Exploration"; READER'S GUIDE: "Oceanographic Research," "Submarine Research Vehicles," "Underwater Exploration"; APPLIED SCIENCE AND TECHNOLOGY INDEX: "Oceanographic Instruments"; LEARNING DIRECTORY: "Ocean, Map," "Oceanography, Instrumentation," "Oceanography, Research Ship").	H	K6	3		2.1.1.2 7.3.1	(C)Resources (V)Inquiry
2. The student knows that various instruments are specially developed for research in and on the oceans.	P I	G2 K2 K7	4	1		(C)Tools (C)Technology (C)Research
3. The student knows the use of the following pieces of oceanographic apparatus: echo sounder, drift bottles, current meter, Nansen bottle, bathy thermograph, dredge, piston corer, tow nets, scuba, bathyscaphe, benthoscope, mesoscaphe.	U H	K2 K7	3 4	1		(C)Tools (C)Technology (V)Utility

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.7 Tools of oceanography (Cont.)						
4. The student knows the various ways of measuring salinity.	U H	K2	3 4	1	6.4.3.1	(C)Measurement
5. The student knows the importance of depth recording devices in charting ocean bottoms, navigation, etc.	P I U H	K2 K9	3 4	1		(C)Data representation (C)Mapping (C)Tools
6. The student knows methods and instruments commonly used to locate positions in the ocean (e.g., loran, shoran, and celestial navigation).	U H	K2	3 4	1	2.2.1.4 5.12.2 6.1.4	(C)Measurement (C)Tools (V)Utility
7. The student knows geophysical measurements made in the oceans and the instruments used (e.g., magnetic, seismic, geothermal, gravitational).	I U H	K2	3 4	1	2.2.1	(C)Tools (C)Measurement (V)Utility
8. The student knows the ways in which wave tanks and shoreline models are used in studying the oceans.	I U H	K2 K7	3 4	1	2.2.4	(C)Research (C)Tools
9. The student knows the types of maps associated with oceanography (e.g., bathymetric, temperature, density maps; navigational charts).	I U H	K2 K5	3 4			(C)Mapping
10. The student knows the importance of maps and charts in oceanographic studies.	P I U H	K2 K9	4	1		(C)Mapping

6. Earth and space sciences
6.4 Oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.7 Tools of oceanography (Cont.)						
11. The student is able to interpret various types of oceanographic maps.	I U H	P41	2 3		7.2	(V)Resourcefulness (V)Utility
12. The student is able to interpret navigational charts.	I U H	P41	2 3		7.2	(V)Resourcefulness (V)Utility
13. The student is able to use effectively the instruments needed to accurately plot or record a course on a navigational chart (e.g., dividers, straightedge; compass, chronometer, sextant).	U H	P35 P45 P66	2 3		2.2.1	(C)Tools (V)Utility (V)Resourcefulness (V)Accuracy

6. Earth and space sciences
6.4 Oceanography
6.4.8 Applications of oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.8.1 Related sciences						
1. The student knows ways in which oceanographic data are used in geological sciences (e.g., plate tectonics, seismology).	I U H	K2 K7	4 6	1	6.3.7.1	(V)Interdependence (V)Inquiry
2. The student knows ways in which oceanographic research has altered or expanded theories about earth's origin, history, structure, or processes.	I U H	G1 K2 K8	4 6	1	6.3	(C)Research (C)Theory (V)Interdependence (V)Inquiry
3. The student knows ways in which oceanographic data are used in studies of alternative futures (e.g., provide information about ocean resources).	I U H	K2 K7	4 6	1	6.3.7.1 8.2.5	(C)Research (V)Problem solving (V)Interdependence
4. The student knows ways in which oceanographic data are used in ecological studies.	I U H	K2 K7	4 6	1	3.4.3 8.2.5	(C)Research (V)Inquiry (V)Interdependence
5. The student knows relationships between oceanography and the biological sciences (e.g., marine biology, taxonomic research).	I U H	K2 K10	4 6	1	8.2.1 8.2.5	(C)History of science (V)Interdependence (V)Inquiry
6. The student knows ways in which oceanographic data are used by meteorological sciences (e.g., weather predicting, climatology).	P I U H	K2 K7	4 6	1	6.2 8.2.4	(C)Research (V)Inquiry (V)Interdependence (V)Utility
7. The student knows ways in which oceanographic data are used by engineering, agricultural, and other applied sciences.	P I U H	K2 K7	4 6	1	6.4.8.2 8.2.5	(C)Research (C)Technology (V)Inquiry (V)Utility (V)Interdependence

6. Earth and space sciences
6.4 Oceanography
6.4.8 Applications of oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.8.2 Economic uses (see also 8.1 Science in careers)						
1. The student knows ways in which oceanographic data are used by fishing industries (e.g., current information; data from which to detect trends, migratory patterns).	P I U H	K2 K7	4 6	1		(V)Utility (V)Interdependence
2. The student knows that oceanographic research vessels transmit information regularly which helps fishermen locate fish, anticipate changing weather or water conditions, etc.	P I U H	K2 K7	4 6	1		(C)Technology (C)Communication (V)Efficiency (V)Utility
3. The student knows ways in which oceanographic data are used in locating and extracting suboceanic natural resources (e.g., petroleum).	P I U H	K2 K6 K7	4 6	1		(C)Natural resources (V)Utility (V)Interdependence (V)Productivity
4. The student knows ways in which oceanographic data are used in design and construction of bridges, canals, waterfront building, roads, etc.	P I U H	K2 K7	4 6	1		(V)Utility (V)Interdependence
5. The student knows ways in which oceanographic data are used for shipping and navigation.	P I U H	K2 K7	4 6	1		(C)Transportation (C)Commerce (V)Utility (V)Interdependence

6. Earth and space sciences
6.4 Oceanography
6.4.8 Applications of oceanography

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
6.4.8.2 Economic uses (Cont.)						
6. The student knows ways in which oceanographic research has contributed to the development of various food production and processing industries (e.g., human food products; animal feed).	P I U H	K2 K7	4 6	1		(C)Technology (V)Productivity (V)Utility (V)Interdependence
7. The student knows ways in which oceanographic research has contributed to the development of various chemical manufacturing industries (e.g., fertilizers, industrial chemicals, medications).	P I U H	K2 K7	4 6	1		(C)Technology (V)Productivity (V)Utility (V)Interdependence
8. The student knows ways in which oceanographic data are used in the design and testing of modern weapons, planning of military strategy, etc.	P I U H	K2 K7	4 6	1		(C)Technology (V)Utility (V)Interdependence
9. The student knows commonly used products which have ingredients extracted or processed from the sea or marine organisms (e.g., cosmetics, fertilizers, food supplements).	P I U H	K2 K7	4 6	1		(C)Natural resources (V)Interdependence (V)Utility

7. Reading and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.1 Foundation competencies for reading science						
1. The student is able to apply reading skills to the field of science (e.g., phonetic analysis, structural analysis, comprehension skills).	P I	P65	5			(C) Data interpretation

7. Reading and science

7.1 Foundation competencies for reading science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.1.1 Establishing purpose						
1. The student is able to identify a purpose for reading scientific material (e.g., to duplicate an experiment someone has already done, to distinguish fact from opinion).	P I	P44	2 3			
2. The student knows that reading scientific material requires concentration (e.g., often has no introductory paragraphs to aid in developing a mind set for reading the subject matter).	P I	K7 K9	3 4			
3. The student knows the ways in which reading in science differs from reading other kinds of literature or other narrative (e.g., reading statements of laws and principles, facts and figures, minute descriptive details vs. reading for style, purpose, theme).	P I	K5	3 4			(C) Data interpretation
4. The student knows that reading scientific material may call for the ability to shift from reading to referring to diagrams, other forms of symbolic representation, and vice versa.	P I	K7 K9	3 4			(C) Data interpretation

7. Reading and science

7.1 Foundation competencies for reading science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.1.2 Building scientific vocabulary						
1. The student knows vocabulary specific to the field of science (e.g., names of elements, species of animals).	P I U H	K1	3 4			
2. The student knows the meaning of the symbols, notations, and abbreviations required for interpretation of the scientific subject matter being studied.	I U H	K2	3 4			(C)Symbols
3. The student knows that symbols may be abbreviated representations of words or expressions (e.g., A, CU).	P I U H	K2	3 4			(C)Symbols
4. The student is able to interpret the chemical equations required for comprehension of the scientific subject matter being studied.	I U H	P41	2 3			
5. The student is able to interpret the mathematical equations required for the comprehension of the scientific subject matter being studied.	I U H	P41 P44	2 3			
6. The student knows that scientific knowledge can only be communicated accurately through carefully standardized vocabulary.	P I U H	G2 K7	3 4			(C)Communication

7. Reading and science
7.1 Foundation competencies for reading science
7.1.2 Building scientific vocabulary

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.1.2.1 Word attack						
1. The student knows affixes used in measurement (e.g., milli, centi, desi, deca, hecto, kilo; ology, graphy).	P I U H	K3	3 4			(C)Measurement
2. The student knows the way in which the parts of a dictionary aid in identifying new words.	P I U H	K7	3 4			

7. Reading and science
7.1 Foundation competencies for reading science
7.1.2 Building scientific vocabulary

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.1.2.2 Word meaning						
1. The student knows the vocabulary of definite and indefinite time expressions (e.g., second, minute, decade; past, future, long ago, age).	P	K2	2 3			(C)Time
2. The student knows the designated time periods in prehistoric and geological time.	I U H	K4 K5	3 4			(C)Time
3. The student knows that structural analysis of scientific words may aid in comprehension (e.g., geology, entomology, centigram, milligram).	P I U H	K7	3 4			
4. The student is able to use representative symbols to represent formulas (e.g., volume).	I U H	P65	2 3			(C)Symbols
5. The student knows symbols used in scientific formulas.	I U H	K2	3 4			(C) Symbols
6. The student knows that derivatives may aid in attaching meaning to words.	P I	K7	3 4			
7. The student knows that some words that have various meanings in common language, have specific, standardized definitions when used in scientific literature (e.g., property, energy, cell, information).	P I	G2 K2 K5	3 4			(C)Language
8. The student is able to use context clues, glossaries, dictionaries, etc. as aids in identifying specific meanings of scientific terms.	P I U H	P41 P42	1 2 3			(V)Resourcefulness (V)Accuracy

7. Reading and science

7.1 Foundation competencies for reading science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.1.3 Adjusting rate to purpose						
1. The student knows the ways in which reading rate is adjusted according to purpose (e.g., skimming for overview, in-depth comprehension, enjoyment).	P I U	K7	3 4			(C)Data interpretation
2. The student knows that the reasons for adjusting reading rate include unfamiliar terms, difficult sentence structure, difficult concepts, difficult and detailed directions, material to be retained in detail, and material with a diagram requiring constant shift from text to diagram.	P I U	K7	3 4			
3. The student is able to adjust his or her reading rate to his or her purpose for reading.	P I U	P65	1 2 3			(V)Efficiency

7. Reading and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.2 Comprehension of scientific literature						
1. The student knows that problem-solving techniques used when reading science include self-questioning about the content (e.g., What is stated? What is expected? What is to be found? What do I already know about this?).	P I U	K7 K9	3 4			(C)Problem solving
2. The student is able to recognize key words within sentences.	P I	P37	2 3			
3. The student knows that ways to improve comprehension skills in science include building vocabulary, attaching meaning to words, identifying main ideas, and noting scientific details.	I U H	K3 K7	3 4			(C)Comprehension
4. The student knows skim reading techniques are useful in science to locate a specific word or specific information, and to get a general impression prior to reading.	I U H	K7	1 3 4			(V)Efficiency
5. The student is able to interpret scientific drawings and diagrams.	P I	P41	2 3			(C)Data interpretation
6. The student is able to interpret pictures and photographs.	P I	P41	2 3			(C)Data interpretation
7. The student is able to read classification tables, charts (e.g., classification of living organisms).	I U H	P41	2 3			(C)Data interpretation (C)Classification

7. Reading and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.2 Comprehension of scientific literature (Cont.)						
8. The student is able to read statistical and mathematical tables.	I U H	P41	2 3			(C)Data interpretation
9. The student is able to read the periodic table of elements.	U H	P41	2 3			(C)Data interpretation (C)Classification
10. The student is able to read longitude and latitude.	P I U	P41 P45	2 3			(C)Measurement
11. The student knows the skills involved in reading a map.	P I	K7	3 4			(C)Data interpretation
12. The student is able to read various types of maps (e.g., topographical, geological, weather, population density, migratory patterns, positions of atoms, etc.).	P I	P41 P45	2 3			(C)Data interpretation
13. The student is able to read computer printouts.	U H	P41	2 3			(C)Data interpretation
14. The student is able to read the directions for carrying out a scientific process (e.g., laboratory procedures).	P I U H	P41	1 2 3			(V)Resourcefulness (V)Self-direction

7. Reading and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.2 Comprehension of scientific literature (Cont.)						
15. The student knows that the steps involved in reading directions or instructions include prereading the entire procedure, reading the procedure carefully, reviewing the procedure in one's mind, reading the diagrams as well as the text, noting terms in boldface italics, and re-reading until the procedure is clearly in mind.	P I U H	K4 K7	3 4			
16. The student knows that written instructions deal with specific details in appropriate sequence, with emphasis on "how to do it."	P I U H	K3 K4	3 4			
17. The student is able to use appropriate techniques to efficiently locate a specific direction as needed for reference while carrying out procedures (e.g., checking off steps as they're completed).	P I U H	P34	1 2 3			(V)Efficiency
18. The student knows that directions for safe and valid conduct of experiments, observations, and demonstrations may be found in lab manuals, scientific texts, workbooks, etc.	I U H	K6	1 3 4			(V)Resourcefulness
19. The student is able to use information from other sources as aids to comprehension of specific material (e.g., supplementary filmstrips, recordings, personal interviews, observations, perceptual extenders).	P I U H	P46 P63	1 2 3 7			(V)Resourcefulness (V)Ingenuity (V)Creativity

7. Reading and science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.2 Comprehension of scientific literature (Cont.)						
20. The student knows that written material which appears difficult or incomprehensible may often be understood when more information is acquired.	P I U H	G2 K7	1 3 4 9			(V)Resourcefulness (V)Mastery (V)Self-confidence

7. Reading and science
7.3 Research, reference, study skills

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.3.1 Location of resources (See also 2.1.1.2)						
1. The student knows that the sources of science materials include television, films, radio, filmstrips, magazines, newspapers, scientific journals, science textbooks, pamphlets, encyclopedias, research papers, own observations, microfilm, and microfiche.	P I U H	K3 K6	1 3 4			(C)Inquiry (V)Resourcefulness
2. The student knows library skills (e.g., use of the card catalog, *Reader's Guide to Periodical Literature*).	I U H	K3 K7	1 3 4			(V)Efficiency
3. The student is able to locate the parts of a book (e.g., table of contents, index, glossary, bibliography, appendix).	P I	P65	2			
4. The student is able to effectively use a variety of reference and retrieval systems.	I U H	P33 P63	1 2 3			(C)Inquiry (V)Resourcefulness (V)Efficiency
5. The student is able to locate an appropriate set of directions for procedures to be used in testing a hypothesis.	I U H	P41 P53	1 2 3			(C)Inquiry (C)Problem solving (V)Resourcefulness (V)Accuracy

7. Reading and science
7.3 Research, reference, study skills

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.3.1 Location of resources (Cont.)						
6. The student is able to follow up "leads" to new information contained in scientific literatures (e.g., footnotes, bibliographies, appendices).	I U H	P41 P63	1 2 3 7			(C)Inquiry (C)Problem solving (V)Resourcefulness (V)Self-confidence (V)Curiosity

7. Reading and science
7.3 Research, reference, study skills

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.3.2 Organizing material (see also 2.1.3 Organizing information)						
1. The student knows a variety of techniques, instruments, and media useful for recording and organizing scientific information acquired through reading.	I U H	K7	1 3 4			(V)Resourcefulness (V)Organization (V)Efficiency
2. The student is able to take personal notes which accurately record information relative to the subject or purpose of the inquiry.	I U H	P23 P37 P66	1 2 3			(C)Data interpretation (C)Inquiry (V)Organization (V)Accuracy
3. The student is able to organize notes or records into an appropriate format for study or interpretation of what was read.	I U H	P34	1 2 3			(C)Data interpretation (C)Inquiry (V)Organization (V)Efficiency

7. Reading and science

7.3 Research, reference, study skills

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.3.3 Evaluating information (see also 2.1.2 Insuring validity and accuracy of information)						
1. The student is able to evaluate written accounts of research performed by others in terms of appropriateness of method, completeness of data necessary for interpretation, and consistency of conclusions with data reported.	I U H	P22	1 2 3			(V)Critical judgment
2. The student is able to select from written materials statements that are relevant to the problem being studied.	P I	P33	1 2 3			(V)Discrimination (V)Efficiency
3. The student is able to distinguish between statements of fact and statements of opinion.	P I	P45	1 2 3			(V)Critical judgment
4. The student is able to distinguish between informational, persuasive, and artistic uses of language when looking for specific information.	P I U H	P45	1 2 3			(V)Critical judgment (V)Accuracy
5. The student knows reasons why the currency of data (how long ago the research was done) is an important criteria in evaluating scientific information needed to solve problems or analyze issues.	I U H	K8 K9	1 3 4 5			(C)Problem solving (C)Research (V)Accuracy (V)Problem solving (V)Critical judgment

7. Reading and science

7.3 Research, reference, study skills

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
7.3.3 Evaluating information (Cont.)						
6. The student is able to detect categories, classification systems, statistical representations, etc. which may contain distortions or exaggerations.	U H	P22	1 2 3			(C)Data representation (C)Classification (V)Clarity (V)Accuracy (V)Critical judgment
7. The student is able to recognize scientific literature which, although related to the subject of inquiry, is too technical or difficult to be immediately useful.	P I U H	P23	1 2 3			(V)Self-knowledge (V)Efficiency
8. The student is able to recognize scientific literature which, although difficult to read, could be immediately useful with some help in interpretation from available resource people or supplementary materials.	P I U H	P23	1 2 3			(V)Self-knowledge (V)Self-confidence (V)Resourcefulness

8. Science and career education

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.1 Science in careers						
1. The student knows that scientific discoveries and technology affect every kind of work done in western society.	P I U H	G2 K10	1 4 6	1		(C)History of science (C)Society (C)Work (V)Participation (V)Interdependence
2. The student knows that skills in using conventional scientific procedures and instruments are either useful or necessary in all fields of work.	I U H	G2 K7 K9	1 3 4 6	1 4		(C)Tools (V)Efficiency (V)Mastery (V)Resource-fulness (V)Adaptability (V)Participation
3. The student knows ways in which mastery of scientific principles and the ability to apply them to everyday situations increase one's ability to function effectively in all life roles.	P I U H	K7	1 4 6	1 2		(C)Tools (V)Efficiency (V)Mastery (V)Resource-fulness (V)Adaptability (V)Participation
4. The student knows that problem solving and inquiry skills are needed in making satisfying personal career decisions.	I U H	K9	1 4 6	4		(V)Predicting (V)Problem solving (V)Inquiry (V)Decision making (V)Self-knowledge (V)Self-direction
5. The student is able to use problem solving and inquiry skills to clarify personal values when making and carrying out career decisions.	I U H	P62 P63 P64 P65	1 2 6	4 5		(V)Self-knowledge (V)Problem solving (V)Inquiry (V)Decision making (V)Judgment (V)Self-direction

8. Science and career education

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2 Career opportunities in science						
1. The student knows that science is a "growth industry" at least equal to the national increase in Gross National Product (GNP), and is predicted to remain this way for the foreseeable future.	U H	K3 K10	4 6	4		
2. The student knows that careers in science are in three general categories: professional, para-professional, nonprofessional.	U H	K3	4 6	4		
3. The student knows that food, shelter, and health are high national priorities, will remain high in the foreseeable future, and require scientific personnel at the professional, para-professional, and nonprofessional levels.	U H	K3 K10	4 6	4		
4. The student knows that professionals in science are usually employed in industry, government, or teaching, or are self-employed.	U H	K3 K5	4 6	4		
5. The student knows that most professional careers in science are in research and development, management, process control, and teaching.	U H	K3 K5	4 6	4		
6. The student knows that professional scientists have mobility in moving between the areas of research and development, management, process control, and teaching.	U H	K3	4 6	4		

8. Science and career education

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2 Career opportunities in science (Cont.)						
7. The student knows that the number of professional scientists working in the United States has been relatively stable for the past five years, and is predicted to remain relatively stable for the foreseeable future.	U H	K3 K10	4 6	4		
8. The student knows that the supply of professional scientists exceeds the demand, and is predicted to remain this way for the foreseeable future.	U H	K3 K4 K10	4 6	4		
9. The student knows that paraprofessionals are in high demand because the current supply is less than the current demand, and is predicted to remain this way for the foreseeable future.	U H	K3 K4	4 6	4		
10. The student knows that nonprofessionals are in high demand because of the continued growth of science and because of the effort to shift from professional or paraprofessional employees to nonprofessional employees through use of semi-automation or instrumental processes.	U H	K3 K8	4 6	4		

8. Science and career education

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2 Career opportunities in science (Cont.)						
11. The student knows that non-professional employment in science may be either directly unrelated to science (e.g., custodial, secretarial, clerical) or related to science (e.g., orderlies in hospitals; stockroom assistants or managers; nontechnical labor for chemical synthesis, distribution, and storage).	U H	K3 K5	4 6	4		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.1 Biological sciences						
1. The student knows the location and use of print and nonprint materials related to careers in the biological sciences (American Institute of Biological Sciences Bulletin summarizes the most important sources).	I U	K6 K7	3 4 6	5		
2. The student knows that the biological sciences include such fields as botany, zoology, microbiology, anatomy, cytology, ecology, embryology, genetics, histology, limnology, morphology, pathology, physiology, and others.	I U H	K1 K5	4 6	4	3. 8.2.5	(C)Specialization (C)History of science
3. The student knows that most professional-level careers in the biological sciences are in the fields of teaching and government.	U H	K3 K5	4 6	4		
4. The student knows that paraprofessional careers in the biological sciences are not clearly defined because the new career areas are developing too rapidly and along lines which are unpredictable (e.g., heart-lung-kidney machine operators, operators of semi-automated medical analysis machines, careers in pollution control, use of space vehicles for biological assays, ambulance personnel).	U H	K3 K4	4 6	4		
5. The student knows that the current demand for paraprofessionals is high in the biological sciences, and is expected to remain high for the foreseeable future.	U H	K3 K4	4 6	4		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.2 Chemistry						
1. The student knows the location and use of print and nonprint materials related to careers in chemistry (e.g., "Career Opportunities for Chemists" as an annual issue of "Chemical and Engineering News," "Men and Molecules" radio broadcasts by the American Chemical Society, local sections of the American Chemical Society or the American Institute of Chemical Engineers).	U H	K6 K7	3 4 6	5		
2. The student knows current and projected distribution of professional chemists' jobs among various categories of employers (e.g., in 1972, 62% were in industry, 24% were in schools, 6% in government, and 8% in other areas).	H	K3 K4	4 6	4		
3. The student knows subdisciplines, areas of specialization, and interdisciplinary studies in which chemists are currently active.	U H	K5	4 6	4	8.2.5	
4. The student knows that the current demand for para-professionals in chemistry is high and will remain high for the foreseeable future.	U H	K3 K4	4 6	4		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.2 Chemistry (Cont.)						
5. The student knows that paraprofessional careers in chemistry are not clearly defined but include analytical chemists for food and drug quality control, laboratory technicians, police and court chemists, and environmental quality control.	U H	K3	4 6	4		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.3 Physics						
1. The student knows the location and use of print and nonprint materials related to careers in physics (most important career information is summarized in "Physics Today," the trade journal of the American Institute of Physics).	U H	K6 K7	3 4 6	5		
2. The student knows that most professional careers in physics are in the fields of teaching and government.	U H	K3	4 6	4		
3. The student knows physics sub-disciplines, areas of specialization, or inter-disciplinary studies related to physics in which research scientists are currently active.	U H	K5	4 6	4	5.18 8.2.5	
4. The student knows that the rapidly growing field of para-professional physics is not clearly defined, but includes various electronic and computer applications to chemistry, biology, and earth science, as well as application of other physical principles to various sciences.	U H	K3	4 6	4		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.4 Earth/space science						
1. The student knows the location and use of print and nonprint materials related to careers in earth/space science (e.g., government and professional publications).	U H	K6 K7	4 6	5		
2. The student knows that earth/space sciences include such fields as geology, oceanography, meteorology and astronomy.	I U H	K3 K5	4 6	4	6.	
3. The student knows professional opportunities in interdisciplinary research and technology which are related to earth/space science (e.g., earthquake control, space technology, communications research and technology, climate control, systems research, environmental research and control).	U H	K3	4 6	4	8.2.5	
4. The student knows opportunities for paraprofessional careers in earth/space and related sciences.	U H	K3	4 6	4		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.5 New or interdisciplinary sciences						
1. The student knows that many professional scientists are currently specializing in new or interdisciplinary sciences (e.g., Scientific Manpower Bulletin shows a 45% increase in the number of professional scientists in United States between 1962 and 1972, but no increase in the number of professional scientists in the traditional disciplines of chemistry, biology, physics, and math).	I U H	K3	4 6	4		
2. The student knows that the most probable growth in numbers of professional scientists will be in the new or interdisciplinary sciences (e.g., macro-molecular biology or chemistry, molecular physics, bioengineering, space scientists, medical physics, materials science).	U H	K3 K4	4 6	4		
3. The student knows that the number of paraprofessionals in the new or interdisciplinary sciences will grow rapidly in the foreseeable future.	U H	K3 K4	4 6	4		
4. The student knows sources of information about careers in medical sciences.	U H	K6	3 4 6	5		

8. Science and career education
8.2 Career opportunities in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Ralated Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.2.5 New or interdisciplinary sciences (Cont.)						
5. The student knows that all D.V.M.'s, M.D.'s, D.D.S.'s, and R.N.'s are certified for practice only after completing a post-baccalaureate training program at an accredited training institution.	U H	K3 K10	4 6	4 5		
6. The student knows that the application to admission ratio at veterinary, medical, dental, and nursing schools is at least 7 to 1 and is predicted to remain high for the foreseeable future.	U H	K3 K4	4 6	4 5		
7. The student knows that the supply of professional medical personnel is controlled by the number of students in the professional schools and is relatively nonrelated to the demand for professional medical personnel.	U H	K3 K10	4 6	4		
8. The student knows that the supply of medical paraprofessionals is not controlled by admission to training programs, but responds to the demand for paraprofessionals.	U H	K3 K10	4 6	4		
9. The student knows that the demand for medical paraprofessionals is high and will remain high for the foreseeable future.	U H	K3 K4	4 6	4		

8. Science and career education
8.3 Career requirements in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.3.1 Professional careers						
1. The student knows that admission to a bachelor's degree program in the sciences usually requires high school biology, chemistry, and mathematics (quite often physics) with a high school grade point average of at least B.	U H	K3	4 6	3 4 5		
2. The student knows that all professional careers in science require post-baccalaureate education (from two to twelve years).	U H	K3 K9	4 6	3 4 5		
3. The student knows that the admission requirements to professional training vary and that specific admission information is found in the annual college and university catalogs.	U H	K3	4 6	3 4 5		
4. The student knows that post-baccalaureate education requires the bachelor's degree with at least a B grade point average.	U H	K3 K9	4 6	3 4 5		
5. The student knows that post-baccalaureate education in all fields of science requires college courses in chemistry, biology, physics, and mathematics.	U H	K3	4 6	3 4 5		

8. Science and career education
8.3 Career requirements in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.3.1 Professional careers (Cont.)						
6. The student knows that post-baccalaureate education in all fields of science requires a minimum of 70% of all bachelor's degree courses in the sciences.	U H	K3	4 6	3 4 5		
7. The student knows that post-baccalaureate education in some fields of science requires a reading knowledge of two foreign languages (usually French, German, or Russian).	U H	K3	4 6	3 4 5		
8. The student knows that personality or personal factors may be important for the admission requirements to medical schools, but less important for admission to study in the physical sciences.	U H	K3	4 6	3 4 5		

8. Science and career education
8.3 Career requirements in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.3.2 Paraprofessional careers						
1. The student knows that most paraprofessional careers in science require post-high school education.	U H	K3 K9	4 6	3 4 5		
2. The student knows that admission to a paraprofessional training program does not require science courses in high school, but that science courses are a competitive advantage.	U H	K3 K10	4 6	3 4 5		
3. The student knows that high school grade point average is a factor in admission to paraprofessional training programs, but that there is no minimum high school grade point average required for admission.	U H	K3 K9	4 6	3 4 5		
4. The student knows that post-high school paraprofessional training can be obtained at community colleges, on apprenticeship programs under the control of a community college, or by on-the-job training in cooperation with a community college.	U H	K3	4 6	3 4 5		
5. The student knows that some paraprofessional careers require less than a high school diploma, but in a tight job market high school graduates are given preference (e.g., ambulance driver, fire and police first aid, operators of diagnostic machines for public health organizations).	U H	K3 K9	4 6	3 4 5		

8. Science and career education
8.3 Career requirements in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.3.2 Paraprofessional careers (Cont.)						
6. The student knows that the admission requirements to paraprofessional training vary and that specific admission information is found in the annual catalogs of community colleges.	U H	K3 K6	4 6	3 4 5		

8. Science and career education
8.3 Career requirements in science

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.3.3 Nonprofessional careers						
1. The student knows that there are no specific training requirements for nonprofessional careers in science (any necessary training is on-the-job training), but that a tight job market makes the high school diploma advantageous.	U H	K3 K9	4 6	3 4 5		

8. Science and career education
8.4 Sources of career training

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.4.1 Professional training						
1. The student knows that professional training is available only through accredited graduate schools.	U H	K3	4 6	3 4		
2. The student knows that most graduate schools are affiliated with colleges or universities, but that some are either autonomous graduate training centers or affiliated with research centers.	H	K3 K10	4 6	4		

8. Science and career education
8.4 Sources of career training
8.4.2 Paraprofessional training

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.4.2.1 Public schools (K-12)						
1. The student knows that paraprofessional training programs or partial training programs are available in K-12 public and/or private schools (usually under special names like "trade" or "technical" or "business" schools).	I U H	K3	4 6	4		

8. Science and career education
8.4 Sources of career training
8.4.2 Paraprofessional training

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.4.2.2 On-the-job training or apprenticeship						
1. The student knows that most community colleges have some form of working agreement with a variety of business or governmental organizations for on-the-job training or apprenticeship programs leading to paraprofessional degrees.	U H	K3	4 6	4		
2. The student knows that some employers hire and train workers, paying low wages during training and standard wages when apprenticeship or training is completed.	U H	K3	4 6	4		

8. Science and career education
8.4 Sources of career training
8.4.2 Paraprofessional training

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.4.2.3 Military services						
1. The student knows that all military services have training programs leading directly or indirectly (through a cooperating community college) to paraprofessional degrees.	U H	K3	4 6	4		

8. Science and career education
8.4 Sources of career training
8.4.2 Paraprofessional training

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.4.2.4 Community colleges						
1. The student knows that all community colleges have a wide variety of training programs leading to paraprofessional degrees.	U H	K3	4 6	4		

8. Science and career education
8.5 Locating specific jobs or training programs
8.5.1 Government agencies or services

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.1.1 Employment offices						
1. The student knows the location of city, county, state, and federal employment offices in the local area and how to use them.	U H	K6 K7	4 6	4 5		(V)Resourcefulness

8. Science and career education
8.5 Locating specific jobs or training programs
8.5.1 Government agencies or services

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.1.2 Court system						
1. The student knows that juvenile counselors, parole officers, and other court agents usually know about jobs, training facilities, and government training programs available to individuals who are under the court's jurisdiction.	U H	K3	4 6	4		(V)Resourcefulness
2. The student knows that all prison and detention facilities have employment and/or training opportunities.	U H	K3	4 6	4		(V)Resourcefulness

8. Science and career education
8.5 Locating specific jobs or training programs
8.5.1 Government agencies or services

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.1.3 Welfare agencies						
1. The student knows that welfare case workers and/or welfare agencies can aid in job and/or training opportunities.	U H	K3	4 6	4		(V)Resourcefulness
2. The student knows that public health workers and/or public health agencies can aid in finding jobs or training opportunities.	U H	K3	4 6	4		(V)Resourcefulness

8. Science and career education
8.5 Locating specific jobs or training programs
8.5.1 Government agencies or services

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.1.4 Military services (including VA)						
1. The student knows that paraprofessional and nonprofessional training opportunities are available to military personnel.	U H	K3	4 6	4		(V)Resourcefulness
2. The student knows that the Veterans' Administration can aid in obtaining training and/or jobs for certain categories of veterans and the veterans' dependents (all veterans have certain limited training benefits available).	U H	K3	4 6	4		(V)Resourcefulness
3. The student knows the location of his or her local Veterans' Administration building or counselor.	U H	K6	4 6	4		(V)Resourcefulness
4. The student knows that local post offices have information about military careers.	U H	K3 K6	4 6	4		(V)Resourcefulness

8. Science and career education
8.5 Locating specific jobs or training programs
8.5.1 Government agencies or services

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.1.5 Government publications						
1. The student knows that job training information is available from the Superintendent of Public Documents, Washington, D. C.	U H	K3 K6	4 6	4		(V)Resourcefulness
2. The student knows that local county and state government offices have publications available concerning job and training opportunities (e.g., career planning guides, civil service information, special recruiting bulletins).	U H	K3 K6	4 6	4		(V)Resourcefulness

8. Science and career education
8.5 Locating specific jobs or training programs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.2 Private employment agencies						
1. The student knows that the yellow pages of local telephone directories list most local employment agencies.	I U H	K3 K6	4 6	4		(V)Resource-fulness
2. The student knows that all private employment agencies listed in the yellow pages charge for their services.	I U H	K3	4 6	4		(V)Resource-fulness

8. Science and career education
8.5 Locating specific jobs or training programs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.3 Advertisements and directories						
1. The student knows that newspapers and trade journals carry advertisements for jobs available and/or list people who are seeking employment.	I U H	K3 K6	4 6	4		(V)Resourcefulness
2. The student knows that some trade journals and union newspapers will carry free advertisements for unemployed workers.	U H	K3	3 4 6	4		(V)Resourcefulness
3. The student is able to locate, read, and follow up on ads for available jobs.	U H	P41 P65	3 4 6	4	2.1.1.2 2.1.4.1 2.1.6.2 7.3.1	(V)Resourcefulness

8. Science and career educatior
8.5 Locating specific jobs or training programs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.4 School placement services						
1. The student knows that many schools (K-12) and most post-secondary schools maintain a job placement bureau on a formal or informal basis.	U H	K3	4 6	4		(V)Resourcefulness
2. The student knows that school staff members (counselors, teachers, etc.) often know of job and training opportunities, and may be helpful in supplying leads and recommendations to prospective employers.	I U H	K3	4 6	4		(V)Resourcefulness

8. Science and career education
8.5 Locating specific jobs or training programs

COURSE GOALS	Level P/I/U/H	Knowledge or Process Classifications (See Yellow Section)	Subject Area Program Goals (See Blue Sec.)	Career Ed. Program Goals (See Green Sec.)	Other Related Content Taxonomy Headings	(C) Concept/ (V) Value Words
8.5.5 Special interest organizations						
1. The student knows that most special interest organizations (e.g., YMCA, YWCA, Community Action Programs, Black Panthers, Valley Migrant League, American Association of University Professors, unions) are active in helping their members get jobs or job training.	U H	K3	4 6	4		(V)Resourcefulness

Appendix I

VALUE ISSUES AND SCIENCE

Acquiring values that govern individual choice and action is a lifetime process. Education for values, unlike education for much knowledge and process learning, is a long-range undertaking. It can therefore succeed best if the methods and procedures of instruction, the personal behavior of teachers and students, and the physical climate and resources of the school are harmonious and consistent with values to which the school is committed.

Values are the inevitable result of experience, and since schools can and do help structure experience for students, it is clear that schools can and do influence values. The public and its educational systems can make explicit those values they wish young people to acquire, and identify and provide those experiences most likely to produce them.

Education for values has two possible major dimensions: teaching for values directly (values inculcation) and helping students clarify values through information and thought process. Inculcation of privately held values has always gone on in the schools at least by implication. The process of making the value goals of the schools public and explicit should tend to limit the values reinforced in the schools to those that are most uniformly and consistently approved by society. Character traits such as reliability, operational ideals such as accuracy, and social ideals such as respect for others are examples of such values.

Value clarification on the other hand is often concerned with controversial issues that require information to understand. It is clearly an appropriate function of public schools to provide a broad and valid information base to help students better understand the value positions taken by persons and groups with respect to such issues and to develop and exercise the students' abilities to form their own value positions.

Issues, by their very nature, cannot be presented as learning outcomes (goals), but they can play an important role in instructional planning by designating important concerns that require information to comprehend and act upon. In curriculum planning they can act as "organizers" around which to assemble learning experiences that are highly motivating.

Although it is not the purpose of this collection to serve as a curriculum guide, the importance of understanding how issues, values, and knowledge (information) are related justifies including a few pages of science-related issues which curriculum planners and teachers should find valuable in organizing process and knowledge learning.

The issues stated on the following pages are by no means comprehensive, nor is the outline of issues completed or validated. The issues are presented only to stimulate consideration of their possible use by teachers in leading students to acquire knowledge and values that are important in meeting personal and social needs and to extend skills of value clarification.

VALUE ISSUES AND SCIENCE

I. Issues Relating to Societal Uses of Science

A. Societal regulation

B. Regulation of science

C. Regulation of life and life processes

D. Regulation of scientific information

E. Interaction of scientists and nonscientists

F. Uses of technology

G. Role of science in society

H. Earth's resources

II. Philosophic Issues That Scientific Information Can Help to Clarify

A. Relationship to oneself

B. One's relationship to humanity

C. One's relationship to nature

D. One's relationship to technology

E. Life and death

F. Biological change

G. Earth's resources

H. Quality of life and living

III. Issues Relating to the Conduct of Scientific Inquiry

A. The inquiry process

B. Validation of knowledge

C. Ethics of experimentation

I. Issues Relating to Societal Uses of Science

A. Societal regulation

1. Does our society's present use of scientific resources promote suffering in future generations? Should we feed starving populations even though it will result in higher populations and more extensive suffering? Should society coerce sterilization of citizens whose offspring might be a burden on society?

2. Under what conditions does the need for societal stability justify institutions in altering an individual's behavior through scientifically developed procedures and devices?

3. Are societal institutions justified in using scientific resources to alter or manage human genetics? (e.g., To prevent birth defects? Improve general intelligence? Strengthen the gene pool? Stabilize society? Limit population growth?)

4. What are the most efficient ways for individuals to cope with the environment? Are the humane ways and the efficient ways in conflict? To what extent?

5. What might justify governmental or private use of scientific or technological devices to monitor or intervene in highly personal matters (e.g., religious beliefs, sexual practices, interactions within families.)

6. What are the implications and consequences of a "national data bank?"

7. What constitutes an "emergency" that requires immediate, all-out efforts and all-out commitment of scientific resources? Who decides?

8. Does a technologically oriented society have responsibilities in the interests of a technologically less advanced society?

9. Under what conditions is society justified in imposing technological or scientific control of air, water, and atmospheric pollution?

10. Should individuals have the right to select a product or a procedure that uses more energy (or pollutes more) than one which uses less energy (or pollutes less)?

11. To what extent should pollution be accepted as the price of convenience?

12. Should society have the right to regulate factors that pollute, deplete, or alter natural systems even though these regulations are seen by individuals as an encroachment on their rights?

13. Does industry have the right to plan the obsolescence of market items for its own economic purposes?

I. Issues Relating to Societal Uses of Science (Cont.)

B. Regulation of science

1. What factors could make the pursuit of some aspects of science--pure or applied--unjustifiable?

2. What justifies the most "basic" science--
   such as research into the nature of rare and uncommon sub-nuclear particles? Black holes in space? Particles that go faster than light? Gravitational waves?

3. Under what conditions, if any, should public resources be used to support research that is conceived by and directed toward private profit?

4. If a level of reward to scientists and institutions is established which is adequate to induce them to continue normal activity, should greater rewards be offered to inspire unusual efforts and potential contributions?

5. Should society give rewards to scientists in appreciation for discoveries which have no immediate economic, political, or social application?

6. To what extent should a society's economic resources be deployed for the development of technological information advantageous in trading with other societies for political or economic gains.

7. To what extent should a society's economic resources be deployed for scientific or technological research whose economic benefits are defended in terms of its side effects? Likely to be of value in producing related or unrelated side effects (e.g., technological side effects of space effort)?

8. Should societal institutions and agencies have a function in weighing the potential good and harm of particular lines of scientific inquiry, decisions concerning justifiability of the research?

9. Upon what bases could a decision be made to discontinue or limit a particular line of research? (Potential misuse that would cause human suffering? Social disorder that might result if research yields information that controverts firmly-held assumptions of society? Economic costs and returns?)

10. To whom should the scientific community be responsible?

11. Who should allocate the resources necessary for scientific research (finances, personnel, etc.).

12. How is the concept of accountability influencing areas of science research (ways in which resources are allocated)?

I. Issues Relating to Societal Uses of Science (Cont.)

B. Regulation of science

13. Are there distinctions to be made between regulation of activities and regulation of thought?

14. In what ways should scientists be accountable to their sources of finding?

15. Should financial support of scientific research imply the right to regulate or control the research (e.g., subjects of inquiry, methods used, reporting and use of discoveries and developments)?

16. Under what conditions, if any, should society support a scientist so that he can pursue his own research interests?

C. Regulation of life and life processes

1. Who should make decisions about the sacrifice or modification of human life and under what conditions?

2. Are there traits which should be eliminated from the human gene pool?

3. How should we regard the possibility of making human beings by prescription?

4. How should the concept of the leveling of population through natural selection and natural disasters be regarded by a society which has the technological ability to control these factors, as well as population itself?

D. Regulation of scientific information

1. Under what conditions might knowledge harm the individual who gains it?

2. Is possible harm to the individual justifiable cause to limit his access to knowledge?

3. Does industry have the right to withhold technological advances to promote existing products for market purposes?

4. Under what circumstances or institutions might a scientist be justified in withholding scientific information?

5. What responsibility does one society have in sharing scientific information and technological advances with other societies? How might circumstances affect such responsibility?

I. Issues Relating to Societal Uses of Science (Cont.)

D. Regulation of scientific information

6. What are the moral implications of the use of electronic machines to take over thinking functions and decision making?

7. How should we regard the possibility of communicating with intelligent life existing elsewhere in the universe?

E. Interaction of scientists and nonscientists

1. What role, if any, should nonscientists have in regulating the activities of science?

2. Do scientists have responsibility for the ways in which their ideas and discoveries are used by others?

3. What is the professional responsibility of scientists to national causes or commitments?

4. What responsibilities do scientists have towards society outside their field of expertise?

5. What responsibility does a scientist have in using prestige gained from an area of science to achieve ends in unrelated areas?

F. Uses of technology

1. Does man have the right to change nature?

2. Does man have the right to attempt to control nature?

3. Should technology attempt to prevent or control natural risks to organisms? Natural risks to other natural resources? If so, under what conditions?

4. What justifies technological risk to organisms? How does this risk compare to natural risks?

5. What responsibility does one society have for the negative secondary effects of its technology on another society?

6. What effects (positive or negative) might a society's technological development have on other societies? What responsibilities do the societies then have to each other?

7. Who should be accountable--legally or morally--for long range unanticipated destructive side effects of technological or scientific developments? (e.g., near-extinction of eagle population from DDT concentration).

I. Issues Relating to Societal Uses of Science (Cont.)

F. Uses of technology

8. When preservation of one valued resource requires use of chemicals or devices which will be destructive to another, on what basis should decisions be made? By whom? (e.g., Tussock moth--forests).

G. Role of science in society

1. How do we decide which scientific inquiry is important to society? Why do different cultures have different priorities?

2. By what criteria and by what person, institutions, or agencies might potential good and harm be predicted? Results be evaluated?

3. What are appropriate measures of the values and costs of pursuing societal goals of scientific inquiry?

4. What relative importance should society attach to pure research, applied research, and technological production?

5. How can individuals within a society, and society itself, deal with a potentially irreversible human-caused impending disaster? (e.g., demise of plankton, DDT in the sea, nuclear disaster, loss of topsoil from farming regions, lowering of water table, population increases, crop diseases, etc.)

H. Earth's resources

1. Should energy resources be distributed within a society, and among societies to better human conditions?

2. Who should control the use of earth's resources? The political system which governs the land on which the resources are found? The explorers and developers of the resources? The "owners" of the land?

3. What is the responsibility of the earth's population at any one time to provide for its own needs out of the natural resources available, as opposed to its responsibility to conserve resources for future populations?

4. To what extent are individuals responsible for their use of resources and the effects? Does adherence to societal norms or laws alone fulfill that responsibility?

5. To what extent do we have individual and group responsibility to influence society in its use of energy resources?

6. At what point does an individual's use of natural resources become a concern of society (i.e., no longer a purely personal concern).

I. Issues Relating to Societal Uses of Science (Cont.)

H. Earth's resources

7. Is an individual justified in holding different standards for society than for himself in using natural resources?

II. Philosophic Issues That Scientific Information Can Help to Clarify

A. Relationship to oneself

1. What am I?
2. What is my role as part of social, biological and physical systems?
3. What is reality?
4. How do limitations of man's sensors affect his definition of reality?
5. How might a thorough study of a limited area of knowledge affect one's perspective about himself?
6. How might a survey of broad areas of knowledge affect one's perspective about himself?

B. One's relationship to humanity

1. Are genetic characteristics sufficient to account for physical, mental, emotional, and social advantages or disadvantages (differences) among individuals?
2. How does language affect one's perception of reality? Do we perceive only those things we have words for? What criteria are used for selecting language to represent reality?
3. What are the sources and roles of taboo?
   Note the three primary realms of taboo on speech and communication of information: religious (heresy), physiological (obscenity), and political (sedition).
   What human needs are met by taboos?
4. What is the feasibility of equitable distribution of earth's resources among its inhabitants? What is equitable?
5. Does the acceptance of or agreement to an ideal moral-ethical basis for activity by cooperating individuals (or agencies) necessarily mean that this basis is possible? Desirable? Efficient? Convenient?

II. Philosophic Issues That Scientific Information Can Help to Clarify (Cont.)

B. One's relationship to humanity

6. In what ways is personal freedom related to the needs of society? Does it exist apart from societal needs?

C. One's relationship to nature

1. What is man's relationship to the rest of nature? Does man have an obligation to all of nature? What constraints should he place on his attempts to dominate and control nature?

2. How is man different from other forms of life?

3. What is man's position in the food web? Should he be at the top of a food pyramid? Is this necessary? Is this justifiable?

4. What is the basis for differences in awareness between human and other forms of life? Are such differences entirely physical?

5. What is intelligence? How many dimensions might it have? Which of these dimensions are we able to assess?

6. What are the differences between human intelligence and that of other life forms? Do levels of intelligence follow normal distributions within nonhuman groups of organisms?

7. To what extent is there interdependence among and between organisms? Among and between living and nonliving matter?

8. To what extent can life be understood in terms of matter, energy, and other quantifiable properties?

9. How is a society's value system (morals, ethics, mores, etc.) influenced by its physical environment?

10. Is the concept of biological evolution related to social evolution and ethical values?

11. When natural catastrophic events can be predicted but with uncertain timing, what action (if any) can (or should) individuals or groups take to avoid harmful consequences?

D. One's relationship to technology

1. Where should mechanical energy replace human energy? When can it be detrimental to humans? When helpful? How do we determine what is helpful and what is harmful? How are the criteria determined?

2. Might man be destroyed by his technology? If so, could this result in the destruction of all life forms? Or in modifications of present life forms?

II. Philosophic Issues That Scientific Information Can Help to Clarify (Cont.)

D. One's relationship to technology

3. Does man have self-destructive tendencies? What might be the purposes? Survival of the population at the expense of individuals? Destruction of the entire population? Might there be no purpose? Are there similar nonhuman tendencies?

E. Life and death

1. When does a human life begin to exist with reference to the times of conception and birth?

2. When does physical death occur; what physical evidences are adequate to define physical death (physical life)? Under what conditions might a normally conscious organism be considered alive though in a suspended unconscious condition? What life functions could be suspended and reinstated in the same organism? After how long a time?

3. What is terminated when life is terminated before the time of natural birth? How does such termination violate what values? What unsatisfied human needs have been interfered with?

4. In what physical respects might an organism's life be said to continue after its death?

5. What physical and other bases account for the differences between conscious and unconscious life?

F. Biological change

1. Could the development of life be a natural consequence of a nonliving physical system?

2. Does technological progress naturally result in the destruction of the conscious life that produced the technology?

3. Are people subject to natural population controls?

4. What are the mathematical implications of population growth? What about the implications of past rates of population growth? What about the implications of present rates for the future?

5. What kinds of influences might work to stabilize human populations?

6. What advantages would accrue from increased population as opposed to those that would accrue from decreased population? What disadvantages?

II. Philosophic Issues That Scientific Information Can Help to Clarify (Cont.)

F. Biological change

7. Do personal values depend on one's level of mental or psychological development? Is one's capacity for psychological development biologically limited? Are most humans biologically or genetically to a level at which values are primarily self-defensive in an immediate sense?

8. Are humans capable, as organisms, of making the psychological adaptations necessary if long-range, world wide socio-economic and political changes must be made to assure survival of our species against threats of pollution, exhaustion of resources, and modern warfare?

G. Earth's resources

1. How does the definition of natural resources depend on societal values?

2. How can we allocate resources for the benefit of all humans? Who should decide? On what basis? Should nonhuman forms of life be considered? How?

3. When consumption of goods and/or services is different between individuals, what factors determine the difference? How might the differences be justified? By a person's contribution to the general welfare? Higher public esteem? Greater shrewdness in accruing wealth? Having been born of particular parents or some particular country? Pure chance?

4. Should the earth's resources be evenly distributed among its inhabitants?

5. How should the world's natural resources be allocated?

6. Why do people respond to questions of resource allocation in different ways? Especially when personal need is not addressed?

7. How does the definition of waste depend on societal values?

8. What factors might affect one's decisions about effective ways to fulfill personal responsibilities for earth resources? Under existing conditions, is social action more important than private behavior (reducing personal energy use, re-cycling waste, eliminating use of pesticides, etc.)? Vice versa?

9. How are the environmental and social impacts of uses of energy related?

II. Philosophic Issues That Scientific Information Can Help to Clarify (Cont.)

G. Earth's resources

10. Under what circumstances might it become necessary for people to reduce or limit their energy consumption?

11. What energy requirements are needed for an individual's survival? How might we define survival? What are acceptable levels? (How well should we eat? How long should we live? How much space should we occupy? What suffering should we be able to avoid? What conveniences should we be able to enjoy?)

12. How can waste of matter and energy be justified? How is waste defined?

H. Quality of life and living

1. What is "quality of life" and how might it be "measured"? How does the concept vary from culture to culture?

2. What importance should be placed on aesthetics as compared with technology?

3. In what ways might a relatively high material standard of living be detrimental to quality of life? Enhance quality of life?

4. How are life-prolonging technological advances related to life-shortening human tendencies resulting from affluence?

5. In what ways might society take advantage of the increased manpower produced by technology that increases man's life span? Is longevity an untapped resource?

6. When does the concern for quality of human life in a society as a whole take precedence over the "best interests" of individual lives?

III. Issues Relating to the Conduct of Scientific Inquiry

A. The inquiry process

1. Should methodologies for securing and processing information be extended to include other than Western methods?

2. Is one method of inquiry "better" than another (or others)? How do conditions regulate the selection of method?

3. What are the limitations in studying life? using dead material? using living material?

4. How should we distinguish between quantifiable and nonquantifiable information when collecting, processing, and/or reporting it? Are intuitive approaches adequate in dealing with nonquantifiable information?

III. Issues Relating to the Conduct of Scientific Inquiry (Cont.)

A. The inquiry process

5. Is there a fundamentally "best" measuring system?

6. In what ways does classification help and in what ways does it hinder understanding?

B. Validation of knowledge

1. What is the relation between belief and proof? Is proof necessary for belief? Is belief necessary to accept proof?

2. Can we validate things by and/or for ourselves? Should we accept someone else's judgment? ("someone else" may refer to scientists)

3. How can data that seem to run counter to experience be resolved with what one knows or believes to be true in his own experience?

4. How does one judge the dependability of reports made (or information circulated) by scientists?

5. Is there information which is known with absolute certainty?

6. Upon what evidence, and under what conditions, does a scientific assumption or hypothesis become accepted as a law of science?

7. How might scientific methods be misapplied?

8. At what point does physical evidence suggest acceptance of an idea on a factual rather than a theoretical basis?
   (i.e., Does seeing an object or person establish its physical reality? If so, at what level of magnification? Human eye? 100x microscope? Electron microscope? Field ion microscope?)

9. How are concepts developed and accepted as valid through time?

10. What are criteria for validating scientific literature?

11. In what respect can data obtained in experimental work be considered factual?

C. Ethics of experimentation

1. Under what circumstances do we have the right to take life (control or kill) in order to study it?

III. Issues Relating to the Conduct of Scientific Inquiry (Cont.)

C. Ethics of experimentation

2. How is life to be regarded by scientists as they use it in pursuit of information? What if this use is unrelated to the best interests of the life itself?

3. How high a value should be put on human life as compared to other forms of life?

4. What moral and ethical values are involved in medical experimentation that involves use of human test subjects. (Use of volunteers? Use of captive groups--prisoner, army enlisters, etc.)

5. What responsibilities does a scientist have with respect to the use or misuse of his experimental findings?

6. Under what conditions might higher value be placed on animal life as compared to plant life (or on plant life as compared to animal life)?

INDEX

Acceleration,
  circular p. 391, g. 2-6
  due to gravity p. 398-399, g. 5-11; p. 430, g. 13, 14
  rectilinear p. 388-389
Accelerator, small particle p. 545, g. 10
Accuracy p. 19, g. 15; p. 33, g. 9; p. 58-60; p. 132, g. 8; p. 171, g. 6
Acid p. 346-347
Acre p. 136, g. 3
Activation energy p. 353, g. 6; p. 354, g. 8, 9
Adaptation p. 225, g. 14
  marine life p. 746, g. 8; p. 748, g. 9
  of populations p. 191, g. 13; p. 272, g. 6-8
  structural p. 197-198, g. 9-18; p. 207, g. 20; p. 208, g. 25; p. 216, g. 8
Additive p. 261-262, g. 15-19
Adhesion p. 435, g. 6, 8
Adiabatic lapse rate p. 643, g. 6
Advection p. 644, g. 16
Agriculture p. 299-300, g. 3-6; p. 723, g. 4; p. 755, g. 7
Air p. 334-335, g. 13-16; p. 638-641
  composition p. 639-640, g. 10-12
  current p. 653, g. 3 (see also: Wind)
  density p. 642, g. 3, 4
  movements p. 642-644; p. 653-656
  pollution p. 296-298; p. 718, g. 1-4
  pressure p. 288, g. 4; p. 639, g. 5-9; p. 642, g. 4; p. 643, g. 6; p. 653, g. 2
  temperature p. 642-644
Air mass p. 651, g. 1, 2; p. 660, g. 6
Alpha radiation p. 364, g. 8, 9; p. 365, g. 11
Alternative futures p. 310, g. 26; p. 722, g. 4; p. 755, g. 3
Amino acid p. 183, g. 10
Ammeter p. 528-529, g. 22-23; p. 530, g. 28
Amorphous solid p. 340, g. 1-3; p. 425, g. 13
Ampere p. 149, g. 2; p. 523, g. 5, 6
Amphibian p. 208, g. 25; p. 233, g. 19; p. 748, g. 12
Amplitude p. 459, g. 15
Analysis p. 29, g. 3, 5; p. 84-85; p. 93, g. 10
Analysis, statistical p. 172, g. 10
Anatomy p. 196, g. 2, 3
Angle,
  measurements p. 140-141; p. 626, g. 1; p. 627, g. 11, 12; p. 628, g. 7
  of declination p. 542, g. 5
  of incidence/refraction p. 462, g. 3, 4
  of incidence/refraction p. 464, g. 3
  of inclination p. 542, g. 7; p. 543, g. 8
Animal,
  aquatic p. 206, g. 17; p. 208, g. 29; p. 745-751
  behavior p. 231, g. 2; p. 239-240, g. 27-29
  classification p. 246, g. 6
  extinct p. 702-703, g. 5-8
  homes p. 232, g. 8-10; p. 277, g. 20
  metabolism p. 188, g. 1-5
  reproduction p. 231-234
  structure p. 204-212; p. 215-216
  tracks p. 208-209, g. 30-33
Antimatter p. 587, g. 9
Apogee p. 631, g. 18
Apothecary unit p. 153, g. 5
Apprenticeship p. 791, g. 1, 2
Archimedes' Principle p. 432, g. 12
Area, measurements p. 136, g. 1-5
Armature p. 549, g. 6; p. 551, g. 18
Arrhenius, acid/base p. 846, g. 4, 5, 6
Asteroid p. 624, g. 6
Astronomy p. 588-635
  instruments p. 628, g. 1-7
  measurements p. 626-627
  prediction p. 608, g. 40; p. 616, g. 5, 7; p. 619, g. 10
  theories p. 589, g. 9; p. 591, g. 4-7; p. 601, g. 1, 2; p. 606, g. 33; p. 607, g. 39; p. 608, g. 40; p. 621, g. 2; p. 623, g. 6; p. 624, g. 5
Atmosphere p. 288, g. 4, 5; p. 296-298; p. 432, g. 8-11; p. 638-641 (see also: Air)
  humidity p. 646, g. 1-4

Atmosphere,
  layers/zones p. 640, g. 13-15
  radiation in p. 641, g. 14-18
  temperature p. 642-644
Atom p. 318-321; p. 325, g. 1-4; p. 330, g. 2; p. 362, g. 2-4; p. 563-565
  alignment p. 538-539, g. 8-11
  historic studies p. 565, g. 12; p. 566, g. 1, 7; p. 567, g. 8, 14, 16
  mass p. 565, g. 10, 11
  spectra p. 570-571
  transmutation p. 576, g. 1, 2
Atomic models p. 319-321, g. 12-28; p. 570, g. 1, 7, 8
Atomic number p. 318, g. 5, 9; p. 567, g. 13; p. 576, g. 2
ATP-ADP cycle p. 182, g. 4
Auditory perception p. 500, g. 9; p. 501, g. 15, 16; p. 505, g. 11-14; p. 506, g. 4-7; p. 507-508, g. 17-21
Auditory perception, skills p. 44, g. 20, 21
Avogadro's Law p. 333, g. 13, 14
Axis, earth (see Earth, axis)

Bacteria p. 264, g. 33
Balance p. 413-415
Barometric pressure p. 656, g. 19, 20
Base p. 346-347
Battery p. 348, g. 4; p. 349, g. 10; p. 525, g. 19; p. 526, g. 2
Bay p. 744, g. 12, 13
Beach p. 728, g. 15; p. 740, g. 4
Beat frequency p. 507, g. 11, 12
Bedrock p. 682, g. 12
Behavior p. 235-240
  analysis of p. 112-113, g. 3-7; p. 237, g. 17; p. 258, g. 2, 3
  classifications p. 236-237, g. 7-16; p. 258, g. 2
  description of p. 122, g. 5, 6
  human p. 258, g. 1-9
  modification of p. 113, g. 8; p. 238-239, g. 24-26
  observation of p. 238, g. 21, 23
  personal p. 1-2, g. 7-14; p. 3, g. 3; p. 5, g. 4; p. 32-33, g. 5-7; p. 112-113
Bernoulli's Theorem p. 434, g. 2
Beta radiation p. 364, g. 8-10
Bias p. 24, g. 3; p. 28, g. 4; p. 60, g. 12-15
Biogeochemical cycle p. 283-284, g. 4-8
Biology p. 173-311; p. 755, g. 5
Biology, careers p. 777, g. 1-5
Biomass p. 279, g. 8; p. 281, g. 11-13
Biome p. 279, g. 8; p. 289, g. 1-3
Biosphere p. 290, g. 1, 2
Bird p. 233, g. 21; p. 743, g. 10; p. 748, g. 13
Bit(binary digit) p. 156, g. 4, 6; p. 190, g. 3; p. 580-581, g. 4-9; p. 582, g. 16
Black hole p. 586, g. 5; p. 593, g. 8, 9
Blood p. 215, g. 1, 2
Bohr Model p. 319, g. 13; p. 320, g. 17-21
Boiling point p. 336, g. 7; p. 344, g. 21; p. 350, g. 6, 7; p. 447, g. 5; p. 448, g. 7
Bombardment, nuclear p. 366, g. 24
Bond p. 319, g. 16; p. 323, g. 1-7; p. 328, g. 1; p. 425, g. 14
Bond, nuclear p. 366, g. 18, 19; p. 524, g. 11
Bond energy p. 182, g. 3, 4
Bone p. 206, g. 13; p. 215-216, g. 3-7
Breeze p. 655, g. 14-17
Brightness p. 474, g. 2
Brightness, apparent/absolute p. 597, g. 12
British Thermal Unit p. 147, g. 6; p. 445, g. 5
Brownian motion p. 351, g. 7; p. 352, g. 8
Burning p. 361, g. 8, 9; p. 446, g. 10, 11
Bushel p. 139, g. 11

Calendar p. 631, g. 14, 17
Calorie p. 146, g. 5; p. 445, g. 4, 6
Calorimeter p. 147, g. 8; p. 357, g. 3
Candle, unit p. 474, g. 3
Capacitance p. 520-522; p. 559-560, g. 17-21
Capillary action p. 435, g. 8; p. 436, g. 9
Carbon p. 369, g. 2-4
Carbon dioxide p. 182, g. 6, 7; p. 183, g. 8; p. 347, g. 10
Carbonate cycle p. 731, g. 12
Career,
  job search p. 794-802
  medical p. 782-783, g. 4-9

- Career,
  - nonprofessional p. 775, g. 10; p. 776, g. 11; p. 788, g. 1
  - para-professional p. 775, g. 9; p. 777, g. 4, 5; p. 778, g. 4, 5; p. 780, g. 4; p. 781, g. 4; p. 782, g. 3; p. 783, g. 8, 9; p. 786-787; p. 790-793
  - professional p. 774-775; g. 3-8; p. 777, g. 3; p. 778, g. 2, 3; p. 780, g. 1-3; p. 781, g. 3; p. 782, g. 1, 2; p. 784-785; p. 789, g. 1, 2
  - requirements p. 784-788
  - training p. 789-802
- Catalyst p. 183, g. 11; p. 354, g. 9; p. 355, g. 4
- Catastrophism p. 293, g. 10; p. 294, g. 12
- Causation p. 86, g. 1
- Cave p. 694, g. 26
- Cell p. 173-194
  - composition p. 174, g. 2
  - functions p. 180-193
  - specialized p. 175, g. 5; p. 194, g. 1
  - structure p. 176-179
  - voltaic p. 348, g. 4; p. 349, g. 10; p. 525, g. 19
- Celsius p. 155, g. 8; p. 441, g. 8, 9
- Centripetal acceleration p. 391, g. 3
- Change,
  - biological p. 292-294; p. 304-305 (see also: Evolution; Genetics)
  - chemical p. 313, g. 5
  - climatic p. 701, g. 8
  - consequences of p. 306-311; p. 750-751, g. 4-11
  - environmental p. 219, g. 11, 12; p. 275, g. 8; p. 292, g. 1; p. 296-307; p. 277, g. 17; p. 292, g. 1; p. 296-303; p. 435, g. 4, 5; p. 750, g. 2, 4; p. 751, g. 8
  - in shoreline p. 741, g. 8-11
  - measurement of p. 225, g. 21
  - of matter p. 330-331, g. 5-8; p. 426, g. 20
  - of state p. 447-450 (see also: Matter, states of)
  - physical p. 296-303; p. 313, g. 6
  - radioactive p. 363-367
  - seasonal p. 221, g. 12; p. 226, g. 26; p. 277, g. 18; p. 611, g. 14-16
- Charge p. 318, g. 1-9; p. 513-514, g. 4-10; p. 515-519; p. 520, g. 1-5; p. 523, g. 1-3; p. 652, g. 3, 4
  - attracting/repelling p. 515, g. 4, 5
  - distribution p. 519, g. 11
  - in magnetic field p. 544, g. 1; p. 547-548, g. 10-12
  - measurements p. 149-150; p. 515, g. 6; p. 517, g. 1, 5; p. 518-519, g. 5-8; p. 520, g. 5; p. 527-530, g. 14-29
  - negative p. 513, g. 4-6
  - neutralization p. 516, g. 10
  - positive p. 513, g. 4-6
  - sources p. 525, g. 17-21
  - transfer p. 515, g. 8; p. 523, g. 1-3
- Charles' Law p. 333, g. 10; p. 334, g. 14; p. 443, g. 12
- Chemical, laboratory p. 163, g. 10-13
- Chemical, symbols p. 319, g. 11
- Chemical bond p. 313, g. 5; p. 323, g. 1; p. 362, g. 5
- Chemical reaction p. 329, g. 10; p. 348, g. 1-3; p. 353-362; p. 568-569, g. 23-25
- Chemistry p. 312-371
- Chemistry, careers p. 778-779
- Choice p. 1, g. 1-3; p. 3, g. 4; p. 582, g. 16
- Chromosome p. 191, g. 12; p. 192, g. 18; p. 257, g. 3
- Circuit p. 520, g. 8; p. 522, g. 15; p. 526-530; p. 531, g. 3-7; p. 536, g. 21; p. 562, g. 30-32
  - AC p. 557-562
  - closed p. 526, g. 3, 4; p. 562, g. 31
  - in magnetic field p. 546, g. 1, 5; p. 547, g. 8; p. 548, g. 13, 14
  - open p. 526, g. 5; p. 562, g. 31
  - parallel p. 527, g. 11-13; p. 529, g. 25: p. 555, g. 12, 14; p. 560, g. 21; p. 561, g. 25, 26
  - resonant p. 562, g. 29
  - series p. 527, g. 10, 12, 13; p. 529, g. 24; p. 555, g. 12, 13; p. 560, g. 21; p. 561, g. 25, 26
- Circulation,
  - human p. 254, g. 17
  - in estuary p. 742, g. 3, 4
  - in ocean p. 733-734
  - in organism p. 211, g. 6; p. 215, g. 1, 2; p. 219, g. 15, 16
- Classification,
  - biological p. 241-251

Classification,
  conventional schemes p. 70-71, g. 14-20; p. 241, g. 1-6; p. 772, g. 6
  skills p. 68-70, g. 1-13; p. 764, g. 7
Climate p. 657-658; p. 701, g. 8; p. 705, g. 7; p. 733-734, g. 5-8
Cloud p. 648, g. 1-8
Coal p. 677, g. 19-21; p. 708, g. 26, 27
Coast (see: Shoreline)
Coding p. 66, g. 1-5; p. 114, g. 1-4
Coefficient,
  of contraction p. 442, g. 5
  of expansion p. 442, g. 4, 6; p. 443, g. 7, 10, 11
  of thermal conductivity p. 452, g. 12
Coherence, light p. 496, g. 1, 2 (see also: Phase)
Cohesion p. 435-436, g. 7-12
Coil p. 544, g. 4; p. 547, g. 6; p. 549, g. 6; p. 553, g. 1-4; p. 554, g. 6-11
Colligative property p. 350, g. 5, 7
Colloid p. 351-352
Col[illegible] p. 362, g. 4
  complementary p. 488, g. 21, 22
  light frequencies p. 485-487, g. 6-19
  perception of p. 44, g. 18, 19; p. 160, g. 8; p. 485, g. 5, 6
  primary p. 488, g. 23, 24
Color code p. 521, g. 14; p. 530, g. 27
Combustion, heat of p. 446, g. 10
Comet p. 623, g. 1-6; p. 624, g. 1
Communication,
  animal p. 239, g. 28
  forms of p. 114-116, g. 3-11
  freedom of p. 16, g. 5
  problems in p. 119-121
  scientific p. 34-35, g. 4-6; p. 66, g. 2; p. 164, g. 5; p. 165-167; p. 758-772
Communication skills,
  giving information p. 118, g. 1-5
  interpersonal p. 11, g. 1, 2; p. 49, g. 8; p. 53, g. 18; p. 81, g. 7, 8; p. 122-126
  reading p. 758-772
Communication system p. 16-17, g. 6-7; p. 34-35; p. 38, g. 1; p. 49, g. 1,3; p. 127, g. 1, 2; p. 164, g. 5
Community, natural p. 278-279; p. 304, g. 3; p. 305, g. [illegible] 10
Community agency p. 263, g. 26, 27, 29; p. 795-799; p. 801, g. 2; p. 802, g. 1
Comparison p. 89-91
Compass p. 542, g. 2-5; p. 613, g. 29
Complexity p. 18-19, g. 5-7
Compound p. 325, g. 4; p. 328-329; p. 564, g. 3; p. 569, g. 24
Compound, organic p. 369-371
Compound machine p. 4[illegible]1, g. 2
Computer p. 628, g. 5, p. 765, g. 13
Computer, programming p. 164, g. 2
Concave p. 478, g. 18, 20, 22; p. 479, g. 24, 27
Concentration (chemical) p. 342, g. 6-11; p. 343, g. 15-20, p. 346, g. 3; p. 350, g. 6; p. 353, g. 2; p. 356, g. 6, 7
Concepts, scientific p. 166, g. 9
Concurrent forces p. 395, g. 10, 11
Condensation p. 447, g. 4, 5; p. 449, g. 12, 17; p. 646, g. 3; p. 647, g. 3-6; p. 648, g. 1; p. 649, g. 1,2
Conductance p. 528, g. 17, 19
Conductance, mutual p. 553, g. 1
Conduction, electric p. 515, g. 8; p. 520, g. 1; p. 523, g. 1-3; p. 524, g. 8-15; p. 544, g. 3-6; p. 545, g. 11
Conduction, thermal p. 451-452, g. 3-13; p. 644, g. 16
Conflict resolution p. 108, g. 16-18
Conservation p. 711, g. 3, 4; p. 712, g. 9-12; p. 751, g. 7-11
Constant p. 587, g. 10
Constellation p. 594, g. 1-7
Continent p. 668, g. 3; p. 688, g. 18
Continental drift p. 688, g. 20; p. 689, g. 23-25
Continental margin p. 728-729, g. 14-20
Contraction p. 438, g. 4; p. 442-444
Convection p. 451, g. 3, 4; p. 452, g. 9, 14-16
Convex p. 478, g. 17, 21; p. 479, g. 23, 27
Coordinates p. 417-418, g. 6-9
Coordination p. 46, g. 33; p. 48, g. 43, 44
Coriolis Force p. 654, g. 6
Coulomb p. 149, g. 2, 3; p. 516, g. 11; p. 519, g. 7; p. 520, g. 5; p. 523, g. 6
Coulomb's Law p. 517, g. 1

Couple p. 401, g. 6
Covalent bond p. 323, g. 2, 6
Covalent compound p. 328, g. 7
Creativity p. 33, g. 11
Criteria p. 94-96
Critical mass p. 578, g. 3, 4
Crustal plate p. 688, g. 18-21
Crystal p. 339, g. 1-8; p. 425, g. 13, 15; p. 670-671, g. 3-6
Cue, nonverbal p. 125, g. 20
Curie point p. 539, g. 12
Current p. 149, g. 2, 5; p. 514, g. 10; p. 523-525; p. 527-529, g. 14-25; p. 531, g. 6; p. 536, g. 16, 21
  air (see: Air, current)
  alternating p. 549-550, g. 3-8, 10; p. 551, g. 19; p. 557-562
  direct p. 529, g. 24; p. 550, g. 8-10; p. 551, g. 19
  in electromagnet p. 544-545
  induced p. 546, g. 1-5; p. 547, g. 8; p. 548, g. 13, 14
  instantaneous p. 557, g. 2
  ocean (see: Ocean, current)
Cycle p. 283-287
  carbonate p. 731, g. 12
  food-mineral p. 284-285, g. 9-18
  gas exchange p. 27-28; p. 287, g. 27-33; p. 288, g. 5
  nitrogen p. 731, g. 13
  water (see: Water cycle)
Cytology p. 177, g. 11, 13, 14

Dalton model p. 319, g. 12, 15
Dalton's Law p. 333, g. 12; p. 334, g. 14
Darwin, Charles p. 292-293, g. 6-9
Data processing, equipment and use p. 164, g. 1-6
Dating p. 367, g. 25; p. 543, g. 11; p. 627, g. 13; p. 707, g. 18
Death p. 180, g. 3, 4; p. 225, g. 14; p. 269, g. 1-4; p. 288, g. 1
Decibel p. 505, g. 10
Decision-making p. 1, g. 1-3; p. 4, g. 6; p. 17, g. 8; p. 20, g. 18-21; p. 33, g. 7; p. 93, g. 19; p. 95, g. 10-12
Declination p. 626, g. 3
Decoding p. 80-81; p. 121, g. 12-14; p. 758-767
Definition, clarification of p. 167, g. 11, 12; p. 168, g. 2; p. 762, g. 7, 8
Definition, statement of p. 58, g. 6
Degree p. 140, g. 7; p. 155, g. 8, 9; p. 418, g. 10; p. 614, g. 34
Delta (geology) p. 697, g. 47
Demagnetize p. 538, g. 4, 5
Demography p. 268, g. 9
Density p. 317, g. 1-4; p. 431, g. 1, 2; p. 432, g. 13; p. 433, g. 18, 19
  air p. 642, g. 3, 4
  magnetic flux p. 541, g. 7-9; p. 545, g. 11; p. 546, g. 5; p. 547, g. 6; p. 548, g. 12
  refraction and p. 480, g. 3-5
  seawater p. 731, g. 14-16; p. 732, g. 1, 2
Deposition p. 695, g. 35; p. 697-698, g. 43-51; p. 740, g. 1, 4, 5, 7
Description p. 75, g. 12
Detritus p. 286, g. 19-22
Development,
  animal p. 232-234
  human p. 255, g. 30
  of organism p. 223-225, g. 5-14
  personal p. 18-22
  plant p. 213, g. 7; p. 227-230
Dew p. 649, g. 1
Dew point p. 646, g. 2-4
Dialectric p. 520, g. 6
Dialysis p. 352, g. 11
Diamagnetism p. 534, g. 8; p. 539, g. 10; p. 540, g. 2
Diastrophism p. 690, g. 29-32
Diffraction p. 465, g. 1-3; p. 491, g. 1-5
Diffraction grating p. 159, g. 1; p. 489, g. 3
Diffusion p. 181, g. 3; p. 352, g. 11; p. 424-425, g. 8-11
Diffusion, of light p. 471, g. 18; p. 476, g. 6
Digestion p. 206, g. 12; p. 253, g. 14, 15; p. 264, g. 34
Direction p. 140, g. 4; p. 383, g. 6; p. 386, g. 1, 4; p. 391, g. 2; p. 417, g. 2; p. 418, g. 10; p. 604, g. 16; p. 626, g. 2
Disease p. 263, g. 25; p. 264, g. 32, 36; p. 265, g. 37-39; p. 271, g. 5, 7
Dispersal p. 279, g. 7; p. 282, g. 16
Displacement p. 386-387, g. 6-9
Displacement, wave p. 459, g. 15; p. 460, g. 22; p. 466, g. 1; p. 467, g. 6
Display p. 168, g. 5; p. 169, g. 9

Dissociation constant p. 347, g. 13
Dissolution, rate of p. 181, g. 5, 6
Dissolving p. 447, g. 6 (see also: Solubility; Solution)
DNA p. 179, g. 8; p. 190-191, g. 1-8, 12; p. 257, g. 3
Doppler Effect p. 506, g. 8, 9
Drainage system p. 694, g. 23, 24
Dram p. 138, g. 8; p. 153, g. 4, 5
Drugs p. 263, g. 28
Dynamics, physical p. 384, g. 10; p. 392-403; p. 629-633
Dynamics, population p. 267-269
Dyne p. 151, g. 6; p. 396, g. 16

Ears p. 209, g. 38; p. 252, g. 2, 3
Earth p. 592, g. 3; p. 600-615
  axis p. 596, g. 1-3; p. 603, g. 12, 15
  crust p. 667, g. 1-5; p. 727, g. 9
  dynamics p. 665, g. 3, 4
  history of p. 699-709
  interior p. 666, g. 1-4; p. 688, g. 16
  models of p. 610, g. 12, 13
  orbit p. 630, g. 13; p. 631, g. 18
  processes p. 665, g. 4; p. 683-698
  structure p. 612, g. 20-22; p. 665-682
  surface p. 668-669
  temperature p. 613, g. 23; p. 641, g. 17
Earthquake p. 685, g. 14; p. 686-688, g. 1-17
Earth/space sciences p. 588-757
Earth/space sciences, careers p. 781, g. 1-4
Echo p. 503, g. 4, 7
Eclipse p. 473, g. 5-7; p. 603, g. 14; p. 619, g. 13-15
Ecliptic, plane of p. 603, g. 12
Ecology p. 281, g. 10; p. 755, g. 4
Ecosystem p. 280-288
Ecosystem, marine (see: Marine ecosystem)
Einstein, Albert p. 470, g. 13; p. 495, g. 12
Elastic limit p. 428, g. 8, 9
Electrical field p. 517, g. 2-5; p. 518-519; p. 547, g. 9
Electricity p. 348-349; p. 512-532 (see also: Charge; Current; Circuit)
  conductors p. 515, g. 8; p. 520, g. 1; p. 523, g. 1-3; p. 524, g. 8-15; p. 544, g. 3-6
  grounding p. 519, g. 9, 10
  induction p. 546-548; p. 549, g. 2
Electricity,
  insulation p. 516, g. 9; p. 520, g. 1; p. 524, g. 9
  measurements p. 149-150; p. 515, g. 6; p. 517, g. 1, 5; p. 518, g. 5; p. 520, g. 3, 5; p. 527-530, g. 14-29; p. 553, g. 5; p. 554, g. 6; p. 557-558; p. 559, g. 14, 15, 18; p. 560, g. 20; p. 561, g. 26
  resistance p. 524, g. 12; p. 527-528, g. 15-19; p. 529-530, g. 24-30
  sources p. 513, g. 7; p. 525, g. 17-19; p. 736, g. 8
  static p. 513, g. 2; p. 515-516; p. 538, g. 6
  symbols p. 526, g. 6
  uses p. 514, g. 14-17; p. 536, g. 22; p. 537, g. 24
Electrochemical series p. 361, g. 6
Electrolysis p. 348, g. 6; p. 349, g. 9
Electrolyte p. 345-349; p. 524, g. 14
Electromagnet p. 544-545
Electron p. 318, g. 2, 4-6; p. 319, g. 13, 14; p. 320, g. 21-25; p. 321, g. 27, 28, 30, 31; p. 513, g. 5, 6
  emission p. 493-495
  transfer p. 515, g. 7; p. 523, g. 3 (see also: Electricity; Current)
Electronegativity p. 321, g. 30; p. 327, g. 16
Electrophoresis p. 352, g. 9
Electrostatics p. 515-516; p. 538, g. 6
Element p. 325-237; p. 564, g. 1, 4-8
Element, radioactive p. 365, g. 12-15; p. 573-574, g. 2-4
Embryo p. 223, g. 6; p. 224, g. 8; p. 225, g. 17-20; p. 232, g. 11-13
Emergency p. 263, g. 29; p. 264, g. 30
emf p. 525, g. 20, 21; p. 527-528, g. 14-16, 21; p. 536, g. 21
emf, induced p. 546-548
Endangered species p. 251, g. 25
Endothermic reaction p. 358, g. 6, 7
Energy,
  activation p. 353, g. 6; p. 354, g. 8, 9
  conversion p. 422, g. 2; p. 438, g. 2; p. 514, g. 12, 13; p. 531-532; p. 536, g. 22; p. 549, g. 1; p. 550, g. 11; p. 579, g. 8
  electrical p. 514, g. 11-13; p. 531-532; p. 536, g. 22; p. 549, g. 1; p. 550, g. 11 (see also: Electricity)

- Energy,
  - flow of p. 184, g. 15; p. 283, g. 2
  - forms p. 146, g. 3; p. 405, g. 1; p. 438, g. 1
  - heat p. 357, g. 2-5; p. 644, g. 16 (see also: Energy, thermal; Heat)
  - ionization p. 322, g. 3
  - kinetic p. 407, g. 1-7; p. 409, g. 3; p. 424, g. 5, 8
  - mass and p. 409, g. 4, 5; p. 569, g. 24; p. 665, g. 4
  - matter and p. 313, g. 8; p. 330-331, g. 5-7; p. 409, g. 1
  - measurements p. 146-147; p. 357, g. 3, 4; p. 405, g. 4; p. 406, g. 5, 8; p. 407, g. 3-5; p. 409, g. 2; p. 445-446; p. 531-532, g. 7-11
  - mechanical p. 404-409; p. 536, g. 22; p. 549, g. 1; p. 550, g. 11
  - nuclear p. 367, g. 26
  - potential p. 408, g. 1-7; p. 409, g. 3
  - radiant p. 453-454, g. 17-24; p. 468-497
  - solar p. 605, g. 23; p. 607-608, g. 34-41
  - stellar p. 599, g. 22; p. 605, g. 26; p. 644, g. 11
  - thermal p. 357-359; p. 438-455; p. 530, g. 31; p. 532, g. 8 (see also: Heat)
  - total p. 409, g. 3
  - transfer p. 396, g. 22; p. 438, g. 5, 6; p. 445, g. 1; p. 451-454; p. 531, g. 4; p. 644, g. 16
  - work and p. 405, g. 2; p. 406, g. 1-8
- Enthalpy p. 358-359, g. 8-14
- Entropy p. 156, g. 2; p. 359, g. 15; p. 455, g. 3, 4
- Environment p. 274-277; p. 710-718
  - change in p. 275, g. 8; p. 277, g. 17; p. 288, g. 3; p. 292, g. 1; p. 296-303; p. 306-311
  - study of p. 274-277; p. 297, g. 8-12; p. 298, g. 15-18; p. 300, g. 8-10; p. 302, g. 7-9, 11; p. 303, g. 12; p. 305, g. 7-10; p. 310-311
- Enzyme p. 183, g. 10, 11; p. 188, g. 3
- Epoch p. 700, g. 1
- Equator p. 542, g. 6
- Equilibrium p. 107, g. 13; p. 349, g. 10; p. 350, g. 4; p. 355-356; p. 394, g. 6; p. 395, g. 12; p. 513, g. 2
- Equilibrium, thermal p. 439, g. 9
- Equinox p. 604, g. 21; p. 610, g. 10; p. 658, g. 8
- Era p. 700, g. 1, 4
- Erg p. 146, g. 5; p. 445, g. 4
- Erosion p. 691-693, g. 1-20; p. 694, g. 25; p. 695, g. 36; p. 696, g. 37, 39-42
  - glacial p. 695-696, g. 31-37
  - gravitational p. 692, g. 13
  - of soil p. 711-712, g. 5-11
  - water p. 692-694, g. 14-25
  - wind p. 696, g. 39-42
- Escape velocity p. 635, g. 4, 5
- Estimate p. 76-77
- Estuary p. 742-743
- Evaporation p. 339, g. 8; p. 426, g. 21; p. 449, g. 12; p. 450, g. 20-22; p. 646, g. 1, 2
- Evolution p. 292-294; p. 702-704
- Evolution, human p. 703-704, g. 9-14
- Exothermic reaction p. 357, g. 5; p. 358, g. 7; p. 568-569, g. 23-25
- Expansion p. 438, g. 4; p. 442-444
- Experimentation p. 31, g. 2; p. 60, g. 16; p. 101-102, g. 12-17, 20; p. 104, g. 29; p. 219, g. 13, 14
- Extrapolation p. 83, g. 9, 10, 13
- Eyes p. 209, g. 37; p. 252, g. 5, 6; p. 260, g. 4, 5; p. 483, g. 25

- Fact, statement of p. 58, g. 5; p. 771, g. 3
- Factor, ecosystem p. 288, g. 3; p. 305, g. 6-9; p. 749, g. 4
- Factor, environmental p. 275, g. 8; p. 276, g. 10-15; p. 304, g. 2; p. 305, g. 6-9; p. 711, g. 7
- Fahrenheit p. 155, g. 9; p. 441, g. 8, 9
- Faraday's Law p. 349, g. 8, 9
- Fault p. 686, g. 5-7; p. 689, g. 26; p. 690, g. 28-31
- Feedback p. 107, g. 13; p. 220, g. 2, 4; p. 221, g. 8
- Feedback, interpersonal p. 124-125, g. 15-18; p. 160, g. 10
- Feelings p. 19, g. 11; p. 47, g. 39-42
- Feelings, description of p. 123, g. 7-12

- Female p. 212, g. 8, 9
- Ferromagnetism p. 534, g. 6; p. 538, g. 2, 3, 8; p. 539, g. 12, 13
- Field (see: Electrical field; Magnetic field)
- Fin p. 208, g. 29
- First aid p. 262, g. 22
- Fish p. 233, g. 22
- Fission p. 366, g. 22; p. 576, g. 6-9; p. 578, g. 1-7
- Floating p. 432-433, g. 15-17
- Flood control p. 715, g. 2
- Flow, energy p. 283, g. 1
- Flow, streamline/turbulent p. 434, g. 1
- Flower p. 202, g. 2; p. 203, g. 9; p. 227, g. 1; p. 229, g. 21; p. 230, g. 22
- Fluid p. 431-433
- Flux p. 540-541, g. 6-9; p. 545, g. 11; p. 546, g. 5; p. 547, g. 6; p. 548, g. 12; p. 555, g. 16
- Focus p. 478, g. 19; p. 482, g. 19; p. 483, g. 20; p. 628, g. 1
- Food, chain/web p. 285-286, g. 14-23; p. 749, g. 2, 3, 7
- Food, cycle p. 284-285, g. 9-18
- Food, human p. 250, g. 23; p. 261-262; p. 264, g. 34, 35; p. 285, g. 12, 13; p. 264, g. 34, 35; p. 757, g. 6
- Foot, unit p. 134, g. 11
- Foot candle p. 474, g. 6
- Force p. 151-152; p. 393-403; p. 632, g. 24
  - binding p. 366, g. 18, 19; p. 524, g. 11; p. 568, g. 21
  - electromagentic p. 513, g. 8; p. 545, g. 11
  - electrostatic p. 517, g. 2-5
  - frictional p. 397, g. 1-6
  - gravitational p. 398-400 (see also: Gravity)
  - intermolecular p. 424, g. 6
  - line of p. 517, g. 3, 4; p. 536, g. 20
  - machine and p. 411, g. 3-5; p. 413, g. 6
  - magnetic p. 540-541
  - measurements p. 151-152; p. 394, g. 5; p. 396, g. 16, 19
  - moment of p. 401, g. 1-6
  - unbalanced p. 394, g. 7; p. 395, g. 14
- Force arm p. 40[illegible] g. 2-4
- Force field analysis p. 105, g. 2, 3
- Formula, molecular p. 324, g. 1
- Fossil p. 676, g. 13; p. 702, g. 1, 4; p. 705-708
  - extraction/preservation p. 706, g. 9-11
  - fuel p. 708, g. 26, 27
  - invertebrate p. 707, g. 15-18
  - plant p. 708, g. 23-25
  - vertebrate p. 707-708, g. 19-22
- Foucault pendulum p. 632, g. 20
- Frame of reference p. 21, g. 25; p. 128, g. 6; p. 168, g. 3; p. 383, g. 1; p. 416-420; p. 626, g. 2
- Freedom p. 16, g. 2, 4
- Freezing point p. 336, g. 2, 3; p. 334, g. 21; p. 350, g. 6, 7; p. 443, g. 9; p. 447, g. 5; p. 449, g. 17
- Frequency p. 429, g. 4, 5
  - light p. 485, g. 4, 7
  - resonant p. 561, g. 25-28
  - sound p. 506-508
  - wave p. 458, g. 8, 13, 14
- Friction p. 397, g. 1-6
- Frost p. 649, g. 2
- Fulcrum p. 413, g. 2, 6, 7
- Function,
  - biological definition p. 178, g. 1
  - cell p. 180-193
  - organisms p. 217-240
  - structure and p. 178-179; p. 198, g. 15, 16; p. 247, g. 11; p. 253, g. 13; p. 254, g. 19
- Functional group p. 370, g. 7-10
- Fusion p. 366, g. 21; p. 577, g. 10-13; p. 586, g. 7; p. 605, g. 26
- Fusion, heat of p. 448, g. 10, 11; p. 449, g. 15
- Futuristics p. 310, g. 25; p. 722, g. 4

- Galaxy p. 592-593
- Gallon p. 138, g. 8; p. 139, g. 11
- Game p. 105-106, g. 4-10
- Gametophyte p. 227, g. 3, 5, 6
- Gamma ray p. 574, g. 8; p. 576, g. 5
- Gas, natural p. 677, g. 22, 23
- Gases p. 330, g. 3, 4; p. 332-335; p. 426, g. 18, 19; p. 443-444, g. 8, 10-14; p. 447, g. 3, 4; p. 448, g. 7-9; p. 449, g. 14, 16, 17; p. 452, g. 9; p. 524, g. 15
- Geiger counter p. 575, g. 10-12
- Gene pool p. 272, g. 1-4, 8

Generalization p. 29, g. 6; p. 93, g. 8; p. 97-98; p. 103, g. 26
Generator p. 549-550, g. 1-10
Genetic engineering p. 193, g. 23-25
Genetics p. 190-193
  human p. 257, g. 1-6
  population p. 272, g. 1-8
Genotype p. 192, g. 20, 21; p. 243, g. 17
Geology p. 663-723; p. 755, g. 1, 2
  economic p. 723, g. 1-6
  environmental p. 710-718
  historical p. 699-709
  physical p. 665-698
  tools p. 719-721
  uses p. 722-723
Gestation p. 223, g. 7
Glacier p. 695-696, g. 31-38
Glands, animal p. 210, g. 42-44
Glands, human p. 253, g. 15; p. 254, g. 18
Grain, unit p. 153, g. 4
Gravity p. 398-400; p. 592, g. 7; p. 632-633, g. 25-27
  center of p. 400, g. 12; p. 401, g. 5
  moon p. 618, g. 3; p. 620, g. 17, 18
  specific p. 432, g. 14
Grazing chain p. 286, g. 19
Greenhouse effect p. 641, g. 17
Group skills p. 126, g. 24-26
Growth rate p. 267, g. 6, 7
Growth rate, controls p. 270-271
Guy-Lussac's Law p. 333, g. 11; p. 334, g. 14

Habitat, adaptations to p. 197-198, g. 8-18; p. 207, g. 20; p. 208, g. 25; p. 216, g. 8; p. 272, g. 6, 7; p. 748, g. 9
Habitat, change in p. 277, g. 17
Half-life p. 365, g. 16, 17; p. 575, g. 13, 14
Harmonics p. 510, g. 8-11
Health p. 260-265
Heart p. 252, g. 7
Heat p. 146, g. 3; p. 147, g. 6; p. 357, g. 2-5; p. 438-439 (see also: Energy, thermal)
Heat, measurements p. 146-147; p. 445-446
Heat, transfer p. 451-454; p. 644, g. 12-16
Hertzprung-Russell Diagram p. 597, g. 8
Hess' Law p. 358, g. 8
Homeostasis p. 220, g. 2-4
Homologous series p. 369-370, g. 5-6
Hooke's Law p. 428, g. 8
Horsepower p. 148, g. 2
Human p. 252-265; p. 703-704, g. 9-14
Humidity p. 646, g. 1-4
Humus p. 681, g. 6; p. 682, g. 13; p. 713, g. 15
Hydrodynamics p. 434, g. 1-7
Hydrometer p. 433, g. 18, 19
Hydrostatics p. 431-433
Hypothesis p. 100-101, g. 5-11; p. 768, g. 5
Hypothesis test p. 101-103
Hysteresis p. 541, g. 11

Iceberg p. 696, g. 38
Ideal Gas Law p. 334, g. 14; p. 444, g. 14
Illumination p. 469, g. 5; p. 474-475, g. 5-7; p. 493, g. 1-5
Image p. 477, g. 8-14; p. 483, g. 21, 22, 25
Impedance p. 559, g. 16; p. 560, g. 22-24
Impulse p. 402, g. 1, 3, 4; p. 403, g. 9
Inch p. 134, g. 11
Inclined plane p. 412, g. 3
Index of refraction p. 464, g. 5; p. 481, g. 8-10; p. 482, g. 13
Inductance p. 553-556
Induction, electromagnetic p. 546-548; p. 549, g. 2; p. 550, g. 12; p. 553, g. 1, 2
Inertia p. 395, g. 13; p. 632, g. 22, 23, 25
Inference p. 82-83
Information,
  accuracy of p. 58-60; p. 771, g. 1-5
  adequacy of p. 771-772
  DNA and p. 190, g. 3
  measurement of p. 156-157; p. 580, g. 4; p. 582-584, g. 13-20
  organizing p. 65-78; p. 770, g. 1-3
  processing p. 24-35; p. 40-127; p. 770-772
  relevance of p. 61, g. 1-5; p. 771, g. 2
  sources p. 50-53; p. 57, g. 1-3; p. 768-769
  valuing p. 18, g. 2; p. 23, g. 1-6
Information science p. 580-584

Information system p. 235, g. 4; p. 580, g. 3, 4; p. 581, g. 11; p. 582, g. 12
Infrared p. 470, g. 12
Infrasonic p. 500, g. 12
Inquiry,
  conditions of p. 16-23
  nature of p. 55-56, g. 7-10; p. 128-130
  processes of p. 24-35; p. 40-127; p. 128, g. 4; p. 129, g. 10; p. 130, g. 14-17
Insect p. 208, g. 26; p. 233, g. 18
Intensity,
  electric field p. 517, g. 5
  light p. 474, g. 3; p. 493, g. 2, 3
  magnetic field p. 541, g. 7
  sound p. 504-505
Interdisciplinary sciences (see: Research, interdisciplinary)
Interdisciplinary sciences, careers p. 782-783
Interference p. 466-467; p. 489-490; p. 507, g. 10
Interpolation p. 83, g. 9-11
Interpretation, skills p. 79-98
Interpretation, statement of p. 59, g. 7-11
Interviewing p. 52-53, g. 15-18
Inverse Square Law p. 475, g. 7
Invertebrate p. 707, g. 15-18
Ion p. 322, g. 1-7; p. 323, g. 1, 3, 5, 7; p. 362, g. 2-4; p. 366, g. 20; p. 525, g. 16; p. 574, g. 2
Ionic compound p. 328, g. 7; p. 345, g. 2
Irrigation p. 716-717, g. 9-13
Irritability p. 189, g. 2; p. 240, g. 32, 33
Isobar p. 656, g. 20
Isotope p. 320, g. 19, 20; p. 325, g. 2; p. 364, g. 5, 6; p. 365, g. 16, 17; p. 568, g. 19; p. 575, g. 13, 14
Issues, analyzing p. 9-10, g. 1-6

Jet stream p. 656, g. 21-23
Joint p. 215, g. 5
Joule p. 146, g. 5; p. 519, g. 7; p. 445, g. 4; p. 531-532, g. 7, 8, 10
Joule's Law p. 532, g. 8
Judgment p. 1, g. 1-3; p. 98, g. 11

Keppler's Laws p. 612, g. 18, 19; p. 633, g. 28
Kilogram p. 144, g. 5
Kilowatt hour p. 146, g. 5; p. 532, g. 11
Kindling temperature p. 446, g. 11
Kinematics p. 383-391
Kinetics p. 353-354; p. 407, g. 1-7
Knowledge, valuing p. 16, g. 1; p. 20, g. 23; p. 23, g. 1-3; p. 32, g. 2
Krypton p. 133, g. 4, 6

Laboratory,
  equipment and use p. 162-163
  manual p. 766, g. 18
  safety in p. 162, g. 4; p. 163, g. 10-13
Land form p. 669, g. 6-11; p. 672, g. 16, 17
  depositional p. 740, g. 7
  erosional p. 692, g. 11; p. 693, g. 19, 20; p. 740, g. 1
  extrusive p. 685, g. 11
  human alteration of p. 300, g. 7
  intrusive p. 684, g. 6
  shoreline p. 739, g. 1-5
Land use p. 712, g. 12; p. 716-717, g. 9-13; p. 723, g. 1
Language,
  as coding system p. 119-120, g. 3-8
  scientific p. 165-167; p. 760-762
  usage p. 762, g. 7, 8; p. 771, g. 3, 4
Laser p. 496-497, g. 2, 3, 6-10
Latitude p. 140, g. 3; p. 614-615, g. 30-36
Law, scientific p. 166, g. 10; p. 170, g. 17
Law of Definite Proportion p. 329, g. 9
Law of Dulong and Petit p. 359, g. 13
Law of Multiple Proportions p. 329, g. 8
Law of Reflection p. 462, g. 4
Law of Universal Gravitation p. 632, g. 26; p. 633, g. 27
Laws of Thermodynamics p. 455, g. 1, 2
Leap second p. 631, g. 15
Leap year p. 631, g. 14
LeChatelier's Principle p. 356, g. 8
Length, focal p. 482, g. 19; p. 483, g. 20
Length, measurements p. 133-135; p. 376, g. 1-5; p. 419, g. 5-7; p. 720, g. 8
Length, of wave p. 458, g. 9, 13, 14
Lens p. 482-484, g. 15-27
Lenz's Law p. 548, g. 14
Lever p. 412, g. 2; p. 413-415

- Life,
  - characteristics of p. 180, g. 6; p. 217, g. 3
  - marine (see: Ocean, life in)
  - origin p. 291, g. 1-5; p. 292, g. 3
  - requirements p. 182, g. 1; p. 183, g. 12-14; p. 217, g. 2; p. 276, g. 16; p. 301, g. 5
  - value of p. 19, g. 8-10
- Life cycle p. 226, g. 24; p. 230, g. 24; p. 233, g. 17-22
- Light p. 453, g. 18; p. 468-497 (see also: Energy, radiant; Radiation)
  - amplification p. 160, g. 11
  - beam p. 476, g. 2, 3; p. 478, g. 16
  - coherent/incoherent p. 496, g. 1, 2
  - diffraction p. 491, g. 1-5
  - from star p. 596-597, g. 6-12; p. 598, g. 20
  - intensity p. 474, g. 3; p. 493, g. 2, 3; p. 627, g. 7, 8
  - interference p. 489-490
  - measurement p. 148, g. 2; p. 474-475; p. 490, g. 7, 11; p. 491, g. 5
  - monochromatic p. 486, g. 9; p. 487, g. 18; p. 489, g. 4; p. 490, g. 7
  - particles and p. 470, g. 9; p. 472, g. 22; p. 494-495, g. 7-12
  - phase p. 490, g. 10; p. 496, g. 1, 2
  - polarization p. 492, g. 1-7
  - polychromatic p. 486, g. 8, 12; p. 487, g. 20; p. 490, g. 8
  - rays p. 472, g. 20; p. 478, g. 19; p. 480, g. 3-5
  - reflection p. 476-479
  - refraction p. 480-484
  - speed of p. 470-471, g. 13-15
  - transmitting materials p. 471, g. 16-19
  - visible p. 469, g. 1; p. 470, g. 12
  - wave length p. 490, g. 7
  - waves p. 470, g. 8; p. 472, g. 21, 22; p. 492, g. 2
- Lightning p. 652, g. 3-6
- Liquid p. 317, g. 2-4; p. 330, g. 3, 4; p. 336-337; p. 426, g. 16, 17; p. 442, g. 6; p. 443, g. 8, 9; p. 447, g. 3, 4; p. 448, g. 7-10; p. 450, g. 20-22; p. 452, g. 9; p. 585, g. 4; p. 645, g. 2
- Liquid, surface phenomena p. 435-436
- Liter p. 137, g. 5, 6
- Litmus p. 346, g. 1-3
- Locomotion p. 207-208, g. 22-30
- Locomotion, human p. 252, g. 10; p. 253, g. 11
- Logic p. 29, g. 2; p. 58-60; p. 82, g. 1-8; p. 97, g. 5-7; p. 108, g. 19, 20
- Longitude p. 140, g. 3; p. 614-615, g. 30-36; p. 630, g. 6, 7, 10, 11
- Longitudinal wave (see: Wave, longitudinal)
- Longshore transport p. 740, g. 2, 3
- Lowry-Bronsted, acid/base p. 347, g. 7, 9
- Lumen p. 148, g. 2
- Luminosity p. 469, g. 6; p. 474, g. 1-5
- Lymph p. 215, g. 2

- Machine p. 411-415
- Magnet p. 534, g. 3; p. 535, g. 9-14
- Magnetic domain p. 539, g. 11
- Magnetic field p. 321, g. 27; p. 536, g. 16, 19-21; p. 540-541, g. 5-10; p. 544-548; p. 549, g. 6; p. 586, g. 8
- Magnetism p. 534-562; p. 586, g. 8
  - earth's p. 542-543
  - induced p. 541, g. 10
  - measurements p. 540, g. 4; p. 541, g. 7-9; p. 543, g. 11; p. 545, g. 11; p. 546, g. 5; p. 547, g. 6, 10; p. 548, g. 12; p. 549, g. 6 p. 553-554, g. 5-6
  - reversals p. 543, g. 9-11
- Magnification p. 483, g. 24; p. 484, g. 26, 27
- Male p. 212, g. 8, 9
- Mammal p. 233, g. 20
- Map p. 668, g. 5; p. 669, g. 9-11; p. 719-720, g. 2-10; p. 765, g. 11, 12
  - oceanographic p. 753-754, g. 9-13
  - weather p. 656, g. 20; p. 660, g. 3, 4; p. 661, g. 10-12
- Marine ecosystem p. 734, g. 12; p. 749, g. 1-7; p. 751, g. 7-9
- Marine life p. 731, g. 11; p. 732, g. 5, 8; p. 734, g. 13; p. 745-751; p. 756, g. 1
  - animal p. 747-748, g. 6-14
  - distribution p. 745-746; p. 747, g. 6, 7
  - economic use p. 756, g. 1, 2; p. 757, g. 6-9
  - estuary p. 743, g. 9-11
  - plants p. 747, g. 2-5

Maser p. 496, g. 4, 5
Mass p. 315, g. 1-3; p. 367, g. 28; p. 375, g. 1; p. 409, g. 4, 5; p. 420, g. 10-14; p. 422, g. 1, 2; p. 423, g. 7, 8; p. 564-565, g. 6-12
  atomic p. 564, g. 6-8; p. 565, g. 10
  average p. 564, g. 6-8
  center of p. 400, g. 13
  critical p. 578, g. 3, 4
  measurements p. 144-145; p. 315, g. 2, 3; p. 375, g. 2-5; p. 414-415, g. 11-16; p. 420, g. 10-14
Mass/energy p. 409, g. 4; p. 420, g. 12-14; p. 422, g. 1, 2; p. 632, g. 21; p. 665, g. 4
Math skills p. 66, g. 3; p. 72, g. 4-7; p. 73, g. 3; p. 74, g. 7-10; p. 75, g. 14-16; p. 76, g. 5, 6; p. 77, g. 10; p. 80, g. 2-4; p. 83, g. 9-14; p. 92, g. 4; p. 109, g. 21; p. 171-172; p. 765, g. 8 (see also: Measurement)
Matter p. 312-340; p. 421-436; p. 513, g. 3; p. 422-436; p. 513, g. 3
  cycling of p. 184, g. 15; p. 283, g. 2
  elasticity p. 427-428
  states of p. 330-340; p. 424-426; p. 438, g. 7; p. 447-450
Matter/energy p. 313, g. 8; p. 330, g. 5; p. 422, g. 2
Measurement p. 90, g. 10; p. 131-157; p. 166, g. 8; p. 373-374; p. 416-420
  accuracy of p. 132, g. 8
  scalar/vector p. 378-381
  standardizing p. 131, g. 3-7
  systems p. 373, g. 1-5
Mechanical advantage p. 411, g. 4-7
Medicine, careers p. 782-783, g. 4-9
Meiosis p. 191, g. 11; p. 223, g. 3; p. 227, g. 4
Melting p. 447, g. 4-6; p. 448-449, g. 10-12
Melting point p. 339, g. 5; p. 340, g. 3; p. 447, g. 5; p. 449, g. 17
Membrane p. 181, g. 2; p. 254, g. 22; p. 352, g. 11
Mental model p. 168, g. 3; p. 169, g. 7
Meson field theory p. 366, g. 19
Metabolism, animal p. 188, g. 1-5
Metabolism, cell p. 180, g. 2, 3; p. 182-188
Metal p. 326, g. 13, 14; p. 327, g. 16, 17, 20, p. 452, g. 8; p. 524, g. 13
Metamorphism p. 678, g. 26-30
Metamorphosis p. 216, g. 9, 10; p. 234, g. 25-27
Meteorite p. 624, g. 3; p. 679, g. 35-38
Meteoroid p. 624, g. 1-5
Meteorology p. 637-662; p. 755, g. 6 (see also: Weather)
Meter p. 133, g. 5-7; p. 135, g. 8
Metric system p. 373, g. 1
Metric unit,
  area p. 136, g. 3
  energy p. 146, g. 4, 5
  force p. 151, g. 6
  length p. 133, g. 5, 6; p. 135, g. 8
  mass p. 144, g. 4, 5
  power p. 148, g. 2
  temperature p. 154, g. 7
  volume p. 137, g. 5, 6
Microorganism p. 197, g. 13; p. 248-249; p. 271, g. 9
Microscope p. 159, g. 5; p. 176-177, g. 4-10
Mil p. 140, g. 7
Mile p. 134, g. 11
Milky Way p. 592, g. 3-6
Mineral p. 670-673; p. 674, g. 2
Mineral, cycling p. 284, g. 9, 10
Minute p. 140, g. 7; p. 142, g. 4
Mirror p. 477-479, g. 9-27
Mitosis p. 191, g. 8, 11
Mixture p. 328, g. 6; p. 341, g. 2, 3
Mixture, separation of p 342, g. 11-13; p. 426, g. 21
Models p. 168-170
Models, geological p. 720, g. 4-10
Moire pattern p. 160, g. 9
Moisture p. 645-649
Moisture, in soil p. 713, g. 15, 16
Mole (chemistry) p. 342, g. 7; p. 343, g. 17, 19, 20; p. 350, g. 6
Molecule p. 313, g. 5; p. 323, g. 1, 7; p. 324-329; p. 330, g. 2; p. 336, g. 5; p. 353, g. 3; p. 362, g. 2-4; p. 424, g. 2-7; p. 569, g. 24, 25
  models p. 179, g. 9; p. 190, g. 4, 6; p. 324, g. 3
  velocity p. 332, g. 4, 5
Momentum p. 402, g. 2, 3, 5, 6; p. 403, g. 8-12; p. 424, g. 5
Monopole, magnetic p. 586, g. 8
Monoran p. 222, g. 19; p. 246, g. 4
Moon p. 618-620, g. 1-18; p. 735, g. 5
Morphology (biology) p. 196, g. 4

Mortality rate p. 269, g. 2, 3; p. 271, g. 3, 4
Motion p. 383-403; p. 417, g. 4, 5
  earth's p. 594, g. 5, p. 609, g. 1-7
  molecular p. 353-354; p. 424, g. 4-7; p. 451, g. 6
  perception of p. 46, g. 31, 32
  periodic p. 429-430
  sun's p. 602, g. 1, 5; p. 605, g. 27
Motor p. 550-552, g. 11-20
Mountain p. 685, g. 14; p. 688, g. 20; p. 689-690, g. 26-31
Mountains, weather and p. 655-656, g. 16-18
Mouth p. 205, g. 8-10
Muscle p. 252, g. 8, 10; p. 253, g. 11
Music p. 510-511, g. 9-15
Mutation p. 190, g. 6; p. 192, g. 19
Mythology p. 588, g. 5; p. 591, g. 2; p. 594, g. 6; p. 637, g. 4, 5

Natural resource p. 251, g. 24; p. 308-309, g. 16-22; p. 711, g. 3, 4; p. 723, g. 1 (see also: Resource management)
Navigation p. 598, g. 14; p. 753, g. 6; p. 754, g. 12, 13; p. 756, g. 5
Nebula p. 595, g. 1, 2
Needs p. 13-15, g. 1-3; p. 20, g. 17; p. 276, g. 16
Nervous system p. 253, g. 16
Neutralization (chemistry) p. 347, g. 8
Neutron p. 318, g. 3-6; p. 513, g. 5; p. 567, g. 15-21
Newton, metric unit p. 151, g. 6; p. 396, g. 16
Newton's Laws p. 395-396, g. 13-17; p. 398, g. 1
Nitrogen cycle p. 731, g. 13
Node p. 467, g. 6
Nonelectrolyte p. 350, g. 1-7; p. 524, g. 14
Nonmetal p. 326, g. 13, 15; p. 327, g. 16, 18, 19
Normality (chemistry) p. 342, g. 7; p. 343, g. 18
North Star (Polaris) p. 596, g. 1-5; p. 598, g. 14-19
Nose p. 252, g. 4; p. 253, g. 12
Notation, scientific p. 132, g. 10; p. 166, g. 7; p. 319, g. 11; p. 526, g. 6; p. 547, g. 7; p. 762, g. 4, 5
Note taking p. 67, g. 1-5; p. 770, g. 2, 3
Nuclear reaction p. 576-579; p. 599, g. 22; p. 605, g. 26; p. 607, g. 36
Nucleus, atomic p. 318, g. 7; p. 319, g. 13; p. 320, g. 17, 18; p. 363-367; p. 567-568, g. 9-23; p. 572-577; p. 586, g. 7
Nucleus, cell p. 177, g. 10, 12
Nuclid p. 364, g. 6, 7
Numbering p. 66, g. 3; p. 72, g. 4
Nutrition p. 261-262, g. 10-20

Observation p. 31, g. 2; p. 60, g. 16; p. 87, g. 11; p. 102, g. 18; p. 128-129, g. 4-9; p. 170, g. 16; p. 172, g. 8; p. 279, g. 9, 10
Ocean p. 726-757
  current p. 733-734
  density p. 731, g. 14, 15; p. 732, g. 1, 2
  depth p. 732, g. 4; p. 753, g. 5
  food web p. 749, g. 2, 5, 7
  layer p. 732, g. 1-5; p. 746, g. 9
  life in p. 745-751 (see also: Marine life)
  natural systems p. 749, g. 6
  shoreline p. 739-744
  use of p. 750-751; p. 756-757
  waves p. 737-738; p. 741, g. 9, 10
  zone p. 732, g. 6-8; p. 745, g. 3-5
Ocean basin p. 688, g. 18; p. 726-729
Ocean basin, topography p. 727-728, g. 11-13; p. 728-729, g. 14-21
Oceanography p. 724-757
  economic uses p. 756-757
  measurements p. 753, g. 4-7
  science of p. 724-725; p. 752-757
Odor, perception of p. 45, g. 26, 27
Ohm p. 524, g. 12; p. 527-528, g. 15, 16, 19; p. 559, g. 14
Ohm's Law p. 527, g. 15; p. 528, g. 10
Opaque p. 471, g. 17; p. 473, g. 1; p. 486, g. 13; p. 487, g. 17
Orbit p. 612, g. 18, 19; p. 620, g. 21; p. 623, g. 1, 3-5; p. 633, g. 27, 28
Orbital velocity p. 635, g. 4, 5
Organelle p. 178, g. 3
Organic chemistry p. 369-371
Organism,
  air-borne p. 197, g. 11; p. 208, g. 26, 28
  aquatic p. 197, g. 9; p. 206, g. 17; p. 208, g. 29 (see also: Marine life)

Organism,
  change in p. 292-294; p. 304-311
  development of p. 198, g. 19; p. 201, g. 11, 12; p. 224-225, g. 10-14
  diversity p. 197, g. 7; p. 288, g. 2
  functions p. 217-240
  identification of p. 199, g. 22-24
  land p. 197, g. 10
  multicellular p. 175, g. 2-6; p. 224, g. 11; p. 292, g. 3
  parts of p. 196-199, g. 5-22
  prehistoric p. 250, g. 17-22; p. 292, g. 3
  regulation in p. 220-222
  structure of p. 174-175, g. 3-6; p. 195-216
  underground p. 197, g. 12
  unicellular p. 175, g. 1; p. 177, g. 12; p. 292, g. 3
Organization, of information p. 28, g. 1-5; p. 65-78
Organs p. 200-201
  animal p. 204-210
  digestive p. 206, g. 12
  food-getting p. 205, g. 8-11
  plant p. 202, g. 2-6; p. 203, g. 8, 9
  reproductive p. 206-207, g. 18-21
  respiratory p. 206, g. 15-17
  sensory p. 209, g. 34-39; p. 216, g. 8
  systems of p. 211-216; p. 218, g. 9
Oscillation p. 429, g. 3-5
Osmosis p. 181, g. 3, 7
Ounce p. 138, g. 8; p. 153, g. 4, 5
Oxidation-reduction p. 348, g. 1, 5, 6; p. 349, g. 9; p. 360-361
Oxygen p. 183, g. 13; p. 262, g. 21; p. 287, g. 27, 28

Paleontology p. 215, g. 6; p. 216, g. 7
Parallax p. 626, g. 5, 6
Paramagnetism p. 534, g. 7; p. 539, g. 9, 12; p. 540, g. 1
Paraphrase p. 122, g. 2-4
Parasite p. 265, g. 37, 38
Particle p. 470, g. 9; p. 472, g. 22; p. 494-495, g. 7-12; p. 571, g. 9, 10; p. 586, g. 6
  alpha p. 574, g. 6
  beta p. 574, g. 7
  deposition of p. 693, g. 17; p. 697, g. 46
Particle,
  soil p. 682, g. 14
  subatomic p. 566-569; p. 586, g. 7
Pascal's Law p. 431, g. 6
Peck p. 139, g. 11
Pendulum p. 430, g. 11-14; p. 632, g. 20
Percentage, solutions p. 342, g. 7; p. 343, g. 15, 16
Perception,
  animal p. 209-210, g. 34-41; p. 216, g. 8; p. 508, g. 21
  auditory (see: Auditory perception)
  extension of p. 48, g. 45, 46; p. 159-161
  human p. 24, g. 1-3; p. 41-42, g. 1-5; p. 128, g. 4; p. 129, g. 8; p. 252, g. 1-6; p. 258, g. 5; p. 485, g. 5
  internal p. 46, g. 34-44
  odor/taste p. 45, g. 26, 27
  of environment p. 235, g. 4, 6
  of motion p. 46, g. 31, 32
  plant p. 214, g. 8
  selectivity of p. 44, g. 20-21; p. 128, g. 5-7
  skills p. 42-49, g. 6-49
  temperature p. 45, g. 22, 23
  touch p. 45, g. 24, 25
  visual (see: Visual skills; Eyes)
Perception check p. 124, g. 13, 14
Perigee p. 631, g. 18
Period p. 429, g. 3
  geologic p. 700, g. 1
  of revolution p. 633, g. 28
  of wave p. 457, g. 7
Periodic Table p. 321, g. 29-31; p. 325-326, g. 6-15
Permeability p. 181, g. 1; p. 352, g. 11
Petroleum p. 677, g. 22, 23; p. 708, g. 26
pH p. 347, g. 11, 12; p. 682, g. 9-11; p. 716, g. 7
Phase,
  current/voltage p. 557, g. 1; p. 558, g. 8, 11; p. 559, g. 18
  light p. 496, g. 1, 2
  of matter p. 330, g. 4; p. 448, g. 7
  of moon p. 619, g. 11-15
  of wave p. 459-460, g. 20-22
Phase reversal p. 490, g. 10
Phenotype p. 192, g. 21; p. 243, g. 17

Photochemistry p. 368, g. 1, 2
Photoelectric effect p. 493-495
Photography, time-lapse p. 159, g. 4
Photometry p. 474-475
Photon p. 494-495, g. 10-11
Photosynthesis p. 182, g. 6; p. 184, g. 15; p. 185-187; p. 213, g. 4; p. 638, g. 3
Physical fitness p. 260, g. 7, 8
Physics p. 372-587
Physics, careers p. 780, g. 1-4
Pint p. 138, g. 8; p. 139, g. 11
Pitch p. 506, g. 4-6
Planet p. 609-617
Plank, Max p. 495, g. 12
Plankton p. 747, g. 4
Plant,
    classification p. 246, g. 6
    evolution of p. 708, g. 23, 24
    flowering p. 227, g. 4
    fossil p. 708 g. 23-25
    growth p. 213, g. 7; p. 227-230
    marine p. 747, g. 2-5
    metabolism p. 188, g. 5
    organs p. 202-203; p. 213-214
    reproduction p. 202-203, g. 4-9; p. 206-207, g. 18-21; p. 213, g. 5; p. 227-230
    respiration p. 287, g. 30
    responses p. 222, g. 15-18
    sensory system p. 214, g. 8
    support system p. 213, g. 6
    tissue p. 202, g. 1, 7
    transport in p. 213, g. 1-3
Plasma p. 215, g. 1
Plate tectonics p. 667, g. 2, 3; p. 688-689, g. 18-25
Polar bond p. 323, g. 7
Polaris (see: North Star)
Polarization p. 159, g. 2; p. 161, g. 14; p. 492, g. 1-7
Poles, earth's p. 604, g. 20; p. 613, g. 25-28
Poles, magnetic p. 535, g. 10-13; p. 543, g. 9, 10; p. 613, g. 27
Pollination p. 228, g. 7; p. 230, g. 23
Pollution, air (see: Air, pollution)
Pollution, water (see: Water, pollution)
Polymer p. 370, g. 11
Population p. 267-272; p. 304-305, g. 3-10; p. 306, g. 4; p. 743, g. 6
Population, human p. 309, g. 20; p. 703-704, g. 12-14
Position p. 140, g. 3, 4; p. 383, g. 1; p. 417, g. 1-4; p. 610, g. 8; p. 614-615, g. 30-36; p. 627, g. 10; p. 753, g. 6
    astronomic p. 610, g. 17; p. 626, g. 1-3; p. 627, g. 10-12
    change of p. 383, g. 2-8; p. 385, g. 1 (see also: Motion)
Postulate p. 129-130, g. 10-14
Posture p. 261, g. 9
Potential, electrical p. 150, g. 1-5; p. 518-519; p. 529, g. 24, 25 (see also: emf)
Pound p. 153, g. 4; p. 396, g. 16
Poundal p. 152, g. 8
Pound-force p. 152, g. 8
Power p. 148, g. 1-4; p. 406, g. 7, 8
    electrical p. 532, g. 9, 10; p. 557, g. 2
    hydroelectric p. 303, g. 14
    measurements p. 148, g. 1-4
    nuclear p. 578-579
Precipitation p. 647, g. 5, 6; p. 648, g. 5; p. 649, g. 1-5
Precision p. 132, g. 8; p. 143, g. 8
Prediction p. 76, g 4; p. 104, g. 28
Predictive validity p. 26, g. 4; p. 56, g. 10
Pressure p. 427, g. 3; p. 431, g. 3-7; p. 434, g. 2
    atmospheric p. 432, g. 8-11; p. 639, g. 5-9; p. 642, g. 4; p. 643, g. 6; p. 656, g. 19, 20
    gases p. 338-334, g. 8-14; p. 336, g. 6, 7
Principle, scientific p. 129, g. 10; p. 130, g. 12, 13; p. 166, g. 10; p. 293-294, g. 9-14; p. 587, g. 10; p. 664, g. 6; p. 665, g. 4; p. 701, g. 9
Prioritizing p. 5, g. 6; p. 14, g. 1
Prism p. 485, g. 1, 3; p. 486, g. 12
Problem-solving, group p. 126, g. 26
    models for p. 31, g. 3; p. 105-109
    personal p. 18, g. 3, 4; p. 31, g. 3; p. 109, g. 23
Procedural model p. 168, g. 4; p. 169, g. 8
Producer-consumer p. 278, g. 3-5; p. 282, g. 14, 15
Protein, cell p. 183, g. 10
Protist p. 222, g. 19
Proton p. 318, g. 1, 4-6; p. 513, g. 5, 6; p. 567, g. 11-14
Pulley p. 412, g. 1, 2; p. 415, g. 17

Quantity p. 373, g. 6; p. 374, g. 7
  relative p. 419-420
  scalar (see: Scalar)
  vector (see: Vector)
Quantum numbers p. 320-321, g. 21-27
Quantum theory p. 494, g. 9, 10
Quart p. 138, g. 8; p. 139, g. 11
Questioning p. 6-7; g. 5-8; p. 53, g. 17

Radian p. 140, g. 7
Radiation p. 451, g. 3, 4; p. 453-454, g. 17-24; p. 573, g. 2; p. 644, g. 16 (see also: Energy, radiant; Light)
  absorption/emission p. 453-454, g. 21-24
  electromagnetic p. 362, g. 2-5; p. 453, g. 17, 18; p. 468-497
  infrared p. 470, g. 12
  ultraviolet p. 470, g. 12
Radioactivity p. 363-367; p. 573-579
Radius, atomic p. 321, g. 19; p. 326, g. 12
Radius, constant p. 391, g. 1
Rainfall p. 649, g. 4, 5
Range, optimum p. 276, g. 14
Reactance p. 559, g. 13-15; p. 560, g. 19, 20
Reactor, nuclear p. 366, g. 23; p. 367, g. 26; p. 578, g. 2; p. 579, g. 8
Reading, for directions p. 765-766, g. 14-18
Reading, skills p. 758-772
Recycling p. 711, g. 2
Reduction (see: Oxidation-reduction)
Reference skills p. 50-52, g. 1-14; p. 768-769
Reflectance p. 476, g. 5
Reflection p. 462-463; p. 476-479
  of sound p. 503, g. 1-4, 7
  specular p. 476, g. 7
  total internal p. 481, g. 11, 12
Refraction p. 464, g. 1-5; p. 480-484
Regulation,
  atmospheric p. 288, g. 4, 5; p. 298, g. 13; p. 641, g. 17
  ecosystem p. 288-289; p. 751, g. 7
  organism p. 220-222
  populations p. 270-271
Relating information p. 86-88
Relativity, theory p. 470, g. 13
Representations p. 24-25, g. 4-8; p. 54-55, g. 3-6
Reproduction p. 223-226 (see also: Genetics)
  animal p. 206-207, g. 18-21; p. 231-234
  asexual p. 191, g. 10
  cell p. 180, g. 5
  human p. 254-256, g. 23-32
  plant p. 202-203, g. 4-9; p. 213, g. 5; p. 227-230
  sexual p. 191, g. 9, 10
Reptile p. 233, g. 17
Research,
  current subjects p. 585-587; p. 662, g. 1; p. 771, g. 5
  interdisciplinary p. 585, g. 1-3; p. 589, g. 9; p. 722, g. 1-4; p. 724, g. 3; p. 755, g. 1-7
  library p. 50-52; p. 768-769
  technology of p. 158, g. 1-5; p. 588, g. 4; p. 628, g. 6; p. 721, g. 11-14; p. 725, g. 5, 6; p. 752-753, g. 2-8
Resistance p. 524, g. 12; p. 527-528, g. 15-19; p. 529-530, g. 24-30; p. 557, g. 1; p. 559, g. 12
Resonance p. 507, g. 13, 14
Resonant frequency p. 561, g. 25-28
Resource management p. 38, g. 3; p. 299-300, g. 4-10; p. 302-303, g. 11-14; p. 306-311; p. 710-718; p. 722, g. 4; p. 723, g. 1-6; p. 736, g. 8; p. 743, g. 7, 11; p. 750-751, g. 5-11; p. 756-757
Resource management, issues p. 298, g. 15-18; p. 300, g. 9-10; p. 302-303, g. 11-12; p. 309-310, g. 17-23; p. 806; p. 810; p. 812-815
Respiration,
  aerobic/anaerobic p. 287, g. 29-33
  animal p. 206, g. 15-17
  cell p. 182, g. 5-9; p. 184, g. 15
Respiration,
  human p. 253, g. 12
  plant p. 287, g. 30 (see also: Photosynthesis)
Response p. 235, g. 1-5; p. 240, g. 31-33
  cell p. 189, g. 1-7
  involuntary p. 220, g. 5; p. 235, g. 5; p. 258, g. 1
  plant p. 222, g. 14-18
Reversible reaction p. 355, g. 3
Revolution p. 609, g. 2, 5; p. 618, g. 2; p. 629, g. 2; p. 630, g. 13

Right ascension p. 626, g. 3
River p. 693, g. 18; p. 694, g. 23, 24
RNA p. 183, g. 10; p. 190, g. 5; p. 257, g. 3
Rock p. 674-680
  extra-terrestial p. 679-680, g. 34-40
  extrusive p. 685, g. 8, 10
  igneous p. 675, g. 5-9; p. 684-685, g. 5-10
  intrusive p. 684, g. 5-7
  metamorphic p. 677-679, g. 24-33
  sedimentary p. 675-677, g. 10-23
  suboceanic p. 727, g. 10
Rocket p. 634, g. 2; p. 635, g. 5
Role playing p. 106, g. 6-10
Root mean square p. 557-558, g. 5-8
Rotation p. 391, g. 6; p. 403, g. 9-12; p. 609, g. 2, 4; p. 618, g. 2; p. 629, g. 3; p. 630, g. 13; p. 631-632, g. 19-21; p. 654, g. 5

Salinity p. 731, g. 14, 16; p. 753, g. 4
Salt p. 345, g. 2
Satellite p. 618-622
Satellite, artificial p. 621-622
Saturation p. 342, g. 8-10; p. 350, g. 4
Scalar p. 379, g. 1; p. 380, g. 1, 5, 7; p. 381, g. 1, 3; p. 385, g. 2; p. 405, g. 8; p. 406, g. 4; p. 407, g. 4; p. 408, g. 5
Science,
  applied p. 723, g. 1-6; p. 755, g. 7; p. 756-757
  careers p. 773-802 (see also: Career)
  conventions of p. 128-172
  interdisciplinary p. 782-783
  nature of p. 128, g. 1-3; p. 591, g. 2; p. 637, g. 5
  role of p. 36-39; p. 773, g. 1-5
Scientific literature p. 759-767; p. 769, g. 6; p. 771, g. 1; p. 772, g. 7, 8
Scientific method p. 100-104
Scientific name p. 66, g. 2; p. 166, g. 6; p. 243-244, g. 18-22; p. 247, g. 14; p. 328, g. 5
Season p. 603, g. 15; p. 609, g. 6; p. 610, g. 9; p. 611, g. 14-16; p. 658, g. 7, 8
Seawater p. 730-731
Second p. 140, g. 7; p. 143, g. 7
Sediment p. 675, g. 10, 11; p. 693, g. 17; p. 697-698, g. 43-51
  chemical p. 676, g. 17
  clastic p. 676, g. 18
Sediment,
  in ocean p. 728, g. 12, 13; p. 730, g. 4
  layers p. 676, g. 13-15; p. 706, g. 8 (see also: Strata)
  organic p. 676, g. 16
Seed p. 202, g. 2; p. 203, g. 8; p. 228-229, g. 9-19
Seismograph p. 687, g. 12-14
Selection, artificial/natural p. 292, g. 5, 6
Selectivity p. 89, g. 1-3; p. 94, g. 2; p. 240, g. 31
Self-inductance p. 554, g. 10
Sense extenders p. 48, g. 46; p. 159-161
Sequencing p. 72, g. 7
Shadow p. 473, g. 1-7; p. 602, g. 4-7
Shape, perception of p. 44, g. 16, 17; p. 45, g. 24, 25
Shoreline p. 739-744
Short circuit p. 530, g. 32, 33
Simple harmonic motion p. 429-430
Simple machine p. 411, g. 1, 3, 6; p. 412, g. 1-7
Simulation p. 106, g. 7
Siphon p. 434, g. 6
Size p. 627, g. 9
Skeleton p. 215, g. 3-6
Skeleton, human p. 252, g. 9; p. 254, g. 21, 22
Skin p. 254, g. 20; p. 260, g. 6
Sleep p. 221, g. 13; p. 263, g. 24
Slide rule p. 164, g. 1
Snell's Law p. 464, g. 3
Society, animal p. 239-240, g. 27-29
Society, values related to p. 16-17; p. 38-39
Soil p. 277, g. 22; p. 299-300; p. 681-682; p. 711-714
  alterations p. 299-300
  classification p. 681, g. 5-8; p. 682, g. 15
  components p. 681, g. 3; p. 682, g. 13; p. 691, g. 6
  conservation p. 711-714
  distribution p. 681, g. 4
  formation of p. 691, g. 1
  moisture p. 713, g. 15, 16
Solar system p. 592, g. 4; p. 600-624
Solar system, origin p. 601, g. 1, 2
Solar time p. 603, g. 3; p. 629, g. 4
Solenoid p. 544, g. 4, 5
Solid p. 330, g. 3, 4; p. 338-340; p. 425, g. 12-15; p. 442-443, g. 6-7; p. 447, g. 3, 4; p. 451, g. 7; p. 524, g. 10-13

- Solstice p. 605, g. 25; p. 610, g. 10; p. 658, g. 8
- Solubility p. 334, g. 15, 18; p. 343, g. 14; p. 361, g. 11
- Solution p. 339, g. 8; p. 341-352; p. 449, g. 17
- Sound p. 498-511
  - absorption p. 503, g. 5-7; p. 504, g. 7
  - amplification p. 160, g. 7; p. 505, g. 15
  - audible p. 507, g. 18
  - frequencies p. 500, g. 9-12; p. 506-508; p. 509-510, g. 1-10
  - intensity p. 504-505; p. 507, g. 17; p. 510, g. 11
  - interference p. 507, g. 10, 11
  - perception of p. 500, g. 9; p. 501, g. 15, 16; p. 505, g. 11-14; p. 506, g. 4-7; p. 507-508, g. 17-21
  - quality p. 509-511
  - reflection p. 503, g. 2-4
  - transmitting media p. 502, g. 1-7
  - velocity p. 506, g. 2, 3
  - wave length p. 499, g. 6; p. 500, g. 8; p. 506, g. 2, 3
  - waves p. 499-501, g. 2-14; p. 507, g. 10
- Space travel p. 631, g. 16; p. 634-635
- Spatial relationships, measurement p. 140-141; p. 417-418; p. 626-627
- Spatial relationships, perception of p. 43, g. 10-15; p. 627, g. 9
- Species p. 242, g. 9; p. 247, g. 10; p. 267, g. 1; p. 288, g. 2; p. 293, g. 8
- Specific gravity p. 432, g. 14
- Specific heat p. 446, g. 7, 8
- Spectroscopy p. 362, g. 1-5; p. 628, g. 3, 4
- Spectrum p. 470, g. 11; p. 485, g. 3; p. 570-571; p. 598, g. 20
- Speed p. 385, g. 1-4; p. 386, g. 1, 3, 4
- Sporophyte p. 227, g. 3, 6
- Square p. 136, g. 3; p. 137, g. 2
- Standardization, of measurements p. 133, g. 3-6
- Standardization, of vocabulary p. 165, g. 1-5
- Star p. 596-599
  - categories p. 597, g. 9, 10
  - life span p. 597, g. 11; p. 627, g. 13
- Statistics p. 172, g. 8-10
- Stereophoto p. 159, g. 3
- Stethoscope p. 159, g. 6
- Storm p. 650-652
- Storm, magnetic p. 606, g. 29, 30; p. 607, g. 38
- Strain p. 427, g. 4-7
- Strata p. 676, g. 14, 15; p. 700, g. 4; p. 709, g. 2
- Stress p. 427, g. 1, 2, 4
- Structure, biological p. 176-179; p. 196-216
  - habitat and p. 198, g. 14
  - volcanic p. 684, g. 6; p. 685, g. 11, 12
- Study skills p. 66-78
- Sublimation p. 449, g. 14
- Subsoil p. 682, g. 12
- Summary p. 78, g. 1-8
- Sun p. 438, g. 3; p. 453, g. 20; p. 597, g. 13; p. 602-608
  - energy p. 607, g. 34-36; p. 608, g. 41
  - layers p. 605, g. 24
  - observation of p. 602, g. 2, 3, 8; p. 604, g. 17, 18
  - origin p. 606, g. 33
  - position in sky p. 602-603, g. 3, 7, 9-12; p. 604, g. 21, 22; p. 611, g. 14-16
  - rotation p. 605, g. 27
  - spots/flares p. 604, g. 17, 18; p. 605-606, g. 27-30; p. 607, g. 37-39
- Sunlight p. 185, g. 1; p. 485, g. 2; p. 607, g. 35; p. 732, g. 5
- Superposition, principle of p. 466, g. 1
- Support system, animal p. 206, g. 13, 14
- Support system, plant p. 213, g. 6
- Surface tension p. 336, g. 4; p. 435, g. 1-5; p. 436, g. 11, 12
- Survival p. 198, g. 18; p. 217, g. 1; p. 225, g. 14; p. 262, g. 21; p. 301, g. 5; p. 306, g. 6; p. 307, g. 7, 11; p. 309-311, g. 22-29; p. 751, g. 8
- Symbol p. 86, g. 3; p. 319, g. 11; p. 762, g. 4, 5 (see also: Notation, scientific)
- Synthesis p. 29, g. 4, 5; p. 92-93
- System p. 107, g. 14; p. 220, g. 2; p. 221, g. 8, 10; p. 314, g. 9
  - aquatic p. 301, g. 2

System,
  living p. 184, g. 16-18; p. 220, g. 1; p. 221, g. 8; p. 371, g. 12
  natural p. 273-311
Systems analysis p. 106-107; p. 288, g. 6

Tachyon p. 586, g. 6
Taste p. 45, g. 26, 27
Taxis p. 240, g. 32, 33
Taxonomy p. 241-244, g. 4-22; p. 246-248
Teeth p. 234, g. 24; p. 260, g. 1-3
Telescope p. 159, g. 5; p. 628, g. 1-2
Temperature,
  air p. 288, g. 4
  and change of matter p. 330, g. 3; p. 331, g. 8; p. 336, g. 2, 3; p. 353, g. 4; p. 355, g. 5; p. 357-359; p. 440, g. 7
  inversion p. 643, g. 8-10; p. 718, g. 4
  measurements p. 154-155; p. 440-441
  of gas p. 332-334, g. 4-15
  perception of p. 45, g. 22, 23
  stellar p. 597, g. 8, 11, 13
  zones p. 640, g. 13
Test design p. 100-101, g. 3-10; p. 103, g. 21
Theoretical model p. 168, g. 6; p. 169, g. 13-15
Thermochemistry p. 357-359
Thermodynamics p. 438-455 (see also: Energy, thermal)
Thermometer p. 155, g. 12; p. 440-441, g. 3-11; p. 646, g. 2
Theory p. 104, g. 27, 28; p. 166, g. 10; p. 169-170, g. 13-19; p. 664, g. 6; p. 665, g. 4; p. 722, g. 1-3; p. 755, g. 2
Thunder p. 652, g. 5
Tidal wave p. 738, g. 10, 11
Tide p. 735-736
Time,
  geologic p. 700-701; p. 707, g. 16, 18; p. 709, g. 1-5
  measurements p. 142-143; p. 377, g. 1-5; p. 419, g. 1-4; p. 603, g. 11; p. 604, g. 16; p. 629-631, g. 4-19
  perception of p. 45, g. 28-30; p. 377, g. 2; p. 419, g. 2
  sidereal p. 629, g. 4; p. 630, g. 8, 9; p. 631, g. 19
  vocabulary p. 72, g. 5; p. 626, g. 4; p. 629, g. 4
  zones p. 629-630, g. 5-12
Tissue p. 200-201; p. 351, g. 4
  animal p. 204, g. 1, 3, 4; p. 205, g. 11; p. 206, g. 13, 14; p. 207, g. 19, 22; p. 209, g. 35, 36
  plant p. 202, g. 1, 6, 7; p. 203, g. 10, 11
Ton p. 153, g. 4
Tongue p. 252, g. 1
Topsoil p. 682, g. 12, 13; p. 711, g. 1; p. 713, g. 13, 19
Torque p. 401, g. 1-6; p. 403, g. 10
Tracks, animal p. 208-209, g. 30-33; p. 279, g. 11
Trajectory p. 390, g. 1-3
Transformer p. 555-556, g. 15-19
Transition state p. 354, g. 7, 8
Translation p. 384, g. 11
Translucent p. 471, g. 18
Transparent p. 471, g. 16; p. 487, g. 19, 20; p. 489, g. 3
Transport, cellular p. 181, g. 1-7
Transport system, plant p. 213, g. 1-3
Transverse wave (see: Wave, transverse)
Tropism p. 222, g. 15, 16; p. 240, g. 32
Tyndall effect p. 351, g. 6

Ultrasonic p. 500, g. 11
Ultraviolet p. 470, g. 12
Uniformitarianism p. 293, g. 9, 11; p. 294, g. 12
Universe,
  earth in p. 611, g. 17
  models p. 589, g. 7, 8
  origin p. 591, g. 1-7

Validation p. 1, g. 4, 5; p. 26-27; p. 54-64; p. 94-95, g. 5-9; p. 130, g. 15
Value clarification p. 1-15; p. 32, g. 4; p. 111, g. 1, 2
Value conflict p. 2, g. 12-14
Value statement p. 3, g. 5; p. 8, g. 1-4
Value system p. 12, g. 1, 2
Van Allen Belt p. 613, g. 24
Vapor p. 449-450, g. 16-22
Vapor pressure p. 336, g. 6, 7; p. 344, g. 21; p. 350, g. 6, 7; p. 450, g. 19
Vaporization, heat of p. 448, g. 8, 9; p. 449, g. 16
Variable p. 100, g. 4; p. 101, g. 13
Vector p. 379, g. 2, 3; p. 380, g. 2-7; p. 381, g. 2, 3; p. 383, g. 8; p. 386, g. 2, 5; p. 388, g. 3; p. 394, g. 2, 6; p. 402, g. 3

Velocity p. 420, g. 8, 9
  circular p. 391, g. 4, 5
  of fluid p. 434, g. 2
  rectilinear p. 386-387; p. 388, g. 7, 8
Vertebrate p. 707-708, g. 19-22
Vibration p. 451, g. 6; p. 499, g. 1, 4; p. 504, g. 4, 5; p. 507, g. 13-16; p. 509-511
Viscosity p. 434, g. 3-5
Visual skills p. 42-44, g. 9-19
Vocabulary, scientific p. 165-167; p. 760-762
Volcano p. 685, g. 11
Volt p. 150, g. 4; p. 518-519, g. 6-7; p. 525, g. 21
Voltage p. 519, g. 7 (see also: emf)
Voltage, alternating p. 549, g. 5; p. 557-558; p. 559, g. 18
Voltage, instantaneous p. 557, g. 2
Voltmeter p. 150, g. 5; p. 528, g. 21; p. 529, g. 23; p. 530, g. 28
Volume p. 137-139; p. 316, g. 1
  dry p. 138-139, g. 9-12
  fluid p. 137-138, g. 4-8; p. 139, g. 12
  gases p. 333-334, g. 7-14; p. 443-444, g. 8, 10-14
  solid p. 137, g. 2, 3
Vulcanism p. 684-685

Waste p. 283, g. 1; p. 307-308; p. 309, g. 18
Water p. 301-303; p. 337, g. 8; p. 343, g. 14; p. 347, g. 13; p. 432, g. 14; p. 613, g. 23; p. 647-649; p. 715-717; p. 726, g. 3
  expansion/contraction p. 443, g. 9
  form p. 668-669, g. 3-11; p. 693-694, g. 21-24; p. 697, g. 47; p. 727, g. 4
  ground p. 694-695, g. 26-30
  light refraction p. 480, g. 1, 2
  ocean p. 730-731 (see also: Seawater; Ocean)
  pollution P. 302, g. 6-11; p. 303, g. 13; p. 435, g. 5; p. 715-716, g. 3-8
  running p. 434, g. 7; p. 692-693, g. 14-20
  transport system p. 694, g. 2, 3
  triple point p. 450, g. 18
  wave p. 737, g. 7
Water cycle p. 286-287, g. 24-26; p. 301, g. 3; p. 647-649
Water table p. 694-695, g. 27-30
Watershed p. 694, g. 24; p. 715, g. 1
Watt p. 148, g. 2; p. 532, g. 10
Wave p. 456-467; p. 571, g. 9, 10
  amplitude p. 459, g. 15; p. 466, g. 5
  diffraction p. 465, g. 1-3
  direction p. 461, g. 1
  frequency p. 458, g. 8, 13, 14
  infrasonic/subsonic p. 500, g. 12
  interference p. 466-467
  length p. 458, g. 9, 13, 14; p. 465, g. 2
  light (electromagnetic) p. 457, g. 5; p. 574, g. 8 (see also: Light; Radiation; Energy, radiant)
  longitudinal p. 458, g. 10; p. 459, g. 15, 17; p. 499, g. 2, 3
  mechanical p. 457, g. 1-3
  ocean p. 737-738
  periodic p. 457, g. 6, 7; p. 458, g. 13, 14
  phase p. 459-460, g. 20-22; p. 463, g. 7, 8
  propagation p. 461, g. 2
  reflection p. 459, g. 18, 19; p. 462-463
  refraction p. 459, g. 18, 19; p. 464, g. 1-5
  seismic p. 687, g. 8-12
  sound p. 499-501 (see also: Sound)
  speed of p. 458, g. 12-14; p. 464, g. 5
  standing p. 466-467, g. 5-7; p. 509, g. 6
  standing matter p. 319, g. 14; p. 320, g. 25; p. 321, g. 26
  transverse p. 458, g. 11; p. 459, g. 15, 16; p. 472, g. 21
  ultrasonic p. 500, g. 11
  velocity p. 461, g. 2; p. 464, g. 1
Wave mechanics model p. 319, g. 14, 16; p. 320, g. 18; p. 321, g. 28
Wave tank p. 753, g. 8
Weather p. 277, g. 19; p. 298, g. 16; p. 607, g. 39; p. 637-662
  control p. 637, g. 4-6; p. 662, g. 1-6
  data p. 659, g. 2; p. 661, g. 8
  map p. 656, g. 20; p. 660, g. 3, 4; p. 661, g. 10-12
  measurements p. 659, g. 2; p. 660, g. 5, 6
  prediction p. 637, g. 4; p. 659-662

Weathering p. 691-698
Weber p. 541, g. 9
Weight p. 398-400
Weight, measurements p. 153, g. 1-5;
  p. 399, g. 7, 8
Well p. 695, g. 30
Wind p. 643, g. 5; p. 653-656
  deflection p. 654, g. 5
  erosion p. 696, g. 39-42
  measurements p. 655, g. 12, 13
  use of p. 654-655, g. 10-11
  velocity p. 654, g. 9
Wing p. 208, g. 26, 28
Work p. 406, g. 1-8; p. 407, g. 7;
  p. 408, g. 2, 4; p. 518, g. 1, 2;
  p. 531, g. 1, 2

X-ray p. 160, g. 12

Yard p. 134, g. 11; p. 135, g. 10

Zygote p. 225, g. 16; p. 227, g. 5

887